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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.

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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 on 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 financial market infrastructures (FMIs). Chapter 2 – Selected Issues – discusses relevant but 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) can be downloaded from the Time Series Management System (SGS) in https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries.

Executive Summary

The Banco Central do Brasil (BCB) deems the National Financial System (SFN) is prepared to face the uncertainties related to the unfolding of the pandemic. Throughout 2020, the SFN reached the highest historical value of provisions for problem assets (PAs), improved capitalization, and maintained comfortable levels of liquidity. Domestic economic activity was consistently recovering until the end of 2020. The first signs for 2021 were also positive, but the scenario is one of caution, as these data have not yet contemplated the effects of the recent sharp increase in Covid-19 cases. Although this is not our baseline scenario, credit losses could be higher than anticipated. Any reversal in economic activity would likely be followed by a quick recovery, especially in the second half of the year, as the effects of vaccination are felt more broadly.[1]

SFN operation was not significantly disrupted due to the good levels of capitalization, liquidity, and provisions built up before the pandemic. In line with the BCB's view in previous Financial Stability Reports (FSRs), management, SFN supervision, as well as the measures promoted by the federal government, the National Monetary Council (CMN) and the BCB, allowed financial institutions (FIs) to act as shock absorbers to the real economy. Even so, there were impacts on the financial health of the system, with the materialization of losses resulting from the reduction in economic activity.

The market is still concerned about the unfolding of the pandemic. The FIs surveyed keep a high level of attention to delinquency and economic activity contraction. FIs believe that delays in vaccination and the emergence of new strains of coronavirus could prolong the health crisis and require more spending to protect the vulnerable population and stimulate the economy. This would increase the already high fiscal risk. Nevertheless, FIs' confidence in financial stability throughout the pandemic has remained high, well above what it was during the 2015-2016 recession.

At the global level, the financial systems of the major economies remain resilient. Systemic risk increased during the pandemic but has been reducing in recent months. Foreign central banks have implemented programs to ensure regular operation of financial markets, safeguarding FIs' liquidity and capital. Several jurisdictions have implemented programs to facilitate financing for non-financial companies and temporarily relax aspects of banking regulation.

Emergency programs have boosted the increase in credit to non-financial companies in Brazil.

- Around 80% of the 11.9% growth in bank credit to companies in the semester was due to governmental credit incentive programs. The credit with incentives was essentially for micro, small, and medium enterprises (MSMEs). Thus, this double-digit growth is not likely to be repeated in the first half of 2021.

- The stock of credit to large companies was stable in the second half of 2020. Annual growth is influenced by the significant volume granted to a restricted group of companies at the beginning of the pandemic, which did not occur in the second semester. Corporate financing via capital markets slowed down, with debenture issues concentrated in a few corporations.

1 Inflation Report, available at https://www.bcb.gov.br/content/ri/inflationreport/202103/ri202103i.pdf.

- The economic and financial situation of companies has improved unevenly. Publicly traded companies recovered profitability and payment capacity in the second semester of 2020. For companies, the inflow has also improved, but sanitary restrictions still negatively impact sectors such as "Media and Leisure" and "Transportation". This improvement should be taken with caution, due to the uncertainties related to the pandemic protraction and unfolding.

- Credit risk increased, but at a slower pace than the increase in the corporate portfolio. This is because the emergency programs, responsible for most of the portfolio's growth, are backed by some sort of guarantee. The share of PAs related to large companies, in turn, rose due to the increase in impaired, though not delinquent, credit operations.

- Although this is not our baseline scenario, credit losses may be higher than estimated. An eventual pandemic protraction may affect credit quality. Most modified loans are already out of the grace period and have shown better credit quality than initially expected.

Household credit has returned to its pre-pandemic pace. Risk has cooled, but the scenario warrants caution.

- Low-interest rates and new indexing factors have boosted real estate credit. The increase has occurred especially with funds from savings accounts. There have not been significant changes in lending patterns by loan-to-value (LTV) or maturity ranges.

- The percentage of household-related PAs has fallen back. The end of the emergency measures and uncertainty about the pandemic protraction and unfolding on income and jobs may worsen the risk. So far, the risk from households is mitigated by adequate provisions. In addition, modified loans have shown higher credit quality than initially expected and have not raised the portfolio risk level.

Banks' profitability has been reduced by the health crisis, but this is not a risk to financial stability.

- The pandemic has reversed the profitability recovery that had been occurring since the 2015-2016 recession. The expectation is for improvement in 2021. If the recovery outlook holds, provision expenses tend to be lower, and services revenues tend to recover. Cost control and intensification of digital service help increase operational efficiency.

- Credit margin has reduced and may come under pressure in the short term with eventual increases in the Selic rate. Return on credit fell faster than the funding cost in the second half of 2020. In this period, credit portfolio advancement occurred in modalities with lower interest rates. In addition, revenues were impacted by the cap on the overdraft interest rate. Funding costs decreased but have risen relative to the base policy rate.

- Services revenues recovered throughout the year. After falling in the first semester, revenues responded positively to the recovery in economic activity and greater flexibility in social distancing measures. Growth was mainly due to revenues from capital markets and payment services, which more than offset the lower revenues from constitutional funds management and bank account fees.

Banking system solvency has returned to pre-pandemic levels.

- Throughout the second half of 2020, the system absorbed the pandemic impacts and gradually recovered solvency, partly thanks to regulation that restricted profit distribution. Net income was higher in the second semester and dividend distribution was lower.

- Capital increased in quantity and improved in quality in the second half of 2020. Most institutions meet all minimum prudential requirements using exclusively Common Equity Tier 1 (CET1), the core capital.

- The level of provisions for PAs is the highest in the historical series. Provisioning has been proving adequate to face losses stemming from both modified and non-modified operations.

Comfortable liquidity allows the banking system to operate without risk and to meet the demand for credit, despite the increase in liquidity costs.

- The average cost of the funding stock has been exceeding the remuneration obtained with highly liquid assets. Funding with fixed remuneration and fixed spreads relative to the Interbank Deposit (DI) rate weighs in the stock rates composition, resulting in costs above the Selic rate. Besides this, funding stock with regulated interest rates has also been putting pressure on the average funding cost.

- All banks that must follow the regulatory minimum liquidity rules have maintained a higher Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR) than required.

- Instruments such as the Term Deposit with Special Guarantee (DPGE) and the Special Temporary Liquidity Line (LTEL-LFG) have secured funds for financial intermediation at smaller banks.

- The BCB believes that FIs can deal with the changes now taking place by redefining their funding, investment, and liquidity management strategies.

Stress test results continue to show a reduction in the effects of the pandemic on the financial system.

- Results continue to corroborate the system's ability to absorb shocks, with no relevant non-compliance. Sensitivity analysis results also indicate good resistance when each risk is simulated separately. Credit, interest, foreign exchange, and real estate devaluation risks are tested. Results remained stable compared to previous tests.

- Recovery in economic activity in the second half of 2020, as well as a capital improvement, have cooled the pandemic effects on the financial system. In the stressed scenario for Covid-19, both provisions and capital needs have reduced. Results from the Covid-19 specific test indicate that losses related to vulnerable companies and workers would require BRL1.5 billion so that all institutions would comply with regulatory limits. This amount corresponds to only 0.1% of the SFN's Regulatory Capital (RC). This is the best specific stress test result for the effects of Covid-19 since the first test was published in April 2020.

- Results of the banking system's liquidity stress tests are of no concern. Banking institutions have improved their resilience to face short-term liquidity shocks. The impact of potential liquidity support to investment funds by the management companies that are part of the banking system still does not represent a point of concern.

In a survey, financial institutions remain concerned about risks to financial stability but keep their confidence in the system stability near an all-time high.

- The biggest concern for FIs is that the pandemic increases defaults and reduces economic activity. This risk has remained high since the beginning of the pandemic.

- Fiscal risks also remained highly mentioned. Increased spending due to the pandemic and difficulty in implementing reforms could raise government debt and increase sovereign risk. According to FIs, vaccination delays and the emergence of new strains of coronavirus are a concern because they could extend the health crisis and require additional spending to protect the vulnerable population and to stimulate the economy.

- Despite the risks, most FIs perceived a recovering economy and high access to funding and liquidity in February 2021. At that time, the perception of the economic cycle was more positive than in August 2020. The percentage of respondents who considered the economy to be in recession or depression had reduced from 65% to 25%.

- The perception of risk appetite was low in February 2021. FIs considered household and corporate leverage to be high. Nevertheless, FIs' confidence in financial stability throughout the pandemic has remained well above what it was during the 2015-2016 recession.

Systemically important FMIs operated efficiently and safely throughout the second half of 2020.

- Intraday liquidity in the payment systems remained above the institutions' needs, resulting in reduced risk of insufficient funds to settle obligations throughout the day. The maximum need for funds in the period was 4.2% of available liquidity.

- Financial risks of the financial assets, securities, and foreign currency markets were duly managed by the FMIs. In the two systems in which B3 S.A. acts as the central counterparty (CCP) – B3 Clearinghouse and B3 Foreign Exchange Clearinghouse – the confidence level of the initial margin model is higher than 99%, in line with the Principles for Financial Market Infrastructures (PFMI). Credit and liquidity exposures were adequately managed by the CCP on all days of the period.

The BCB has incorporated the Cyber Resilience Improvement Program (Parc) into the Agenda BC#.

- The Parc aims to ensure an integrated and systemic vision of the SFN's and the Brazilian Payments System's (SPB) entities exposure to cyber risk and to develop preemptive and response actions to (i) frauds in payments systems; (ii) cyber incidents that may result in leakage of personal data or data protected by bank secrecy; and (iii) unavailability of critical services and functions to financial stability.

- In Parc, over the next eighteen months, cyber risk profiles will be developed, enabling the design of a risk map that consolidates the exposure of institutions to cyber risk. In addition, practices will be established to enable a timely response to major cyber incidents, bringing the SFN fully in line with international recommendations.

The new payment arrangement enacted by the BCB, Pix, started operating in 2020, with a high-security level.

- The BCB built Pix with the SPB agents' involvement. Pix works 24 hours a day, every day of the year, and allows the transfer of funds between transactional accounts in an instantaneous, simple, and safe manner.

- Pix has three security dimensions to ensure transaction integrity. The first concerns user digital authentication, the second deals with communications security and system infrastructure, and the third refers to mechanisms to prevent fraud and data leakage.

- Pix transactions can only be initiated in a secure environment, accessed through a password or other security devices integrated into the cell phone, such as biometric and facial recognition. Transaction information traffic is encrypted on the National Financial System Network (RSFN).

- All Pix participants must ensure compliance with (i) the CMN's and the BCB's operational risk and cyber risk rules and (ii) rules on policy, procedures, and internal controls aimed at preventing the use of the SFN for crimes of assets, rights, and values laundering or concealment.

The study indicates that, regarding climate risk, short-term weather fluctuations would have little impact on banks. Persistent fluctuations would reduce credit supply and increase defaults.

- The research on climate risk is a collaborative effort between the BCB and academia. Results reveal that the effect of short-term climate change, such as droughts and floods, is limited. This is because banks are adapting and reducing their credit exposure in the areas most vulnerable to this type of weather event. Economic activity also seems to avoid these areas, which reduces deposits and demand for loans. The fact that FIs reduce their activities in the areas most subject to climate risk does not generate substantial aggregate risk for the SFN.

- A structural change in temperature and rainfall regime would substantially impact the financial system. This analysis was prepared according to the Intergovernmental Panel on Climate Change (IPCC) scenario. Long-lasting climate changes, as opposed to changes for short periods and extreme events, could generate relevant impacts for the banking sector.

- Bank lending to green sectors is lower than lending to high-impact sectors, but this relative share is increasing since 2011.

Decisions of the Financial Stability Committee on the Countercyclical Capital Buffer

At its regular meetings on November 19, 2020, and March 2, 2021, the Financial Stability Committee (Comef) decided to keep the Countercyclical Capital Buffer for Brazil ($ACCP_{Brasil}$) at 0%.[2] Although there is uncertainty regarding the behavior of delinquency and insolvency of SFN debtors due to the unfolding of the Covid-19 pandemic, the Committee considers that the financial system is resilient to these risks.

In 2020, banks strengthened provisions for expected losses and retained most of their profits to absorb unexpected losses. In general, banks voluntarily keep capital and liquidity at levels above prudential requirements. Banks' resilience is verified through analyses and stress testing, which are assessed at Comef meetings and disclosed in the Comef minutes and the FSR.

Given this scenario, the Comef recommends that financial institutions continue to adopt a cautious capital management policy due to the uncertainties still present. In addition, in April 2021, the Capital Conservation Buffer ($ACP_{Conservação}$) will start to be reinstated.

The Comef found that credit expanded in 2020, with no sign of excesses, and available information indicates that asset prices are behaving in line with economic fundamentals.

Thus, considering current conditions and expectations regarding the behavior of the credit market and asset prices, the Comef judges appropriate to keep the $ACCP_{Brasil}$ at 0% at least until the end of 2021. These decisions were made by the Comef in carrying out its duties provided for in the regulations attached to Circular 3,927, of February 11, 2019, and followed principles and objectives described in Communiqué 30,371, of January 30, 2017.

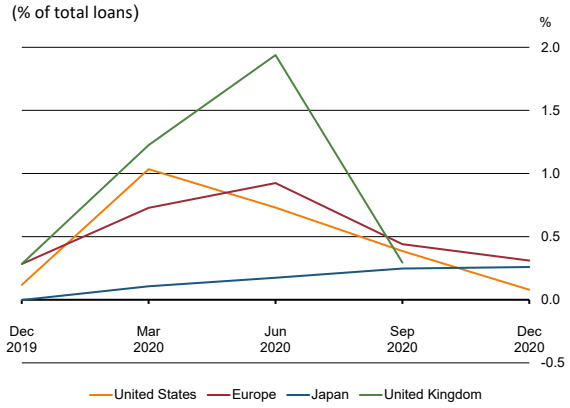
2 Communiqués 36,418, of November 19, 2020, and 36,830, of March 2, 2021.

1 Assessment of National and International Financial Systems[3]

1.1 International financial markets

The financial system of the main economies remains resilient. Since the beginning of the Covid-19 pandemic, Financial Institutions (FIs) preserved capital by setting up provisions for credit losses in the face of higher default risks (Chart 1.1.1). FIs also maintained appropriate liquidity levels, supported by central banks' programs implemented to ensure the smooth functioning of financial markets.

Chart 1.1.1 – Provision for Credit Losses*
(% of total loans)



* Median of a sample of 137 US banks, 38 European banks, 5 UK banks and 3 Japanese banks.
Source: Bloomberg

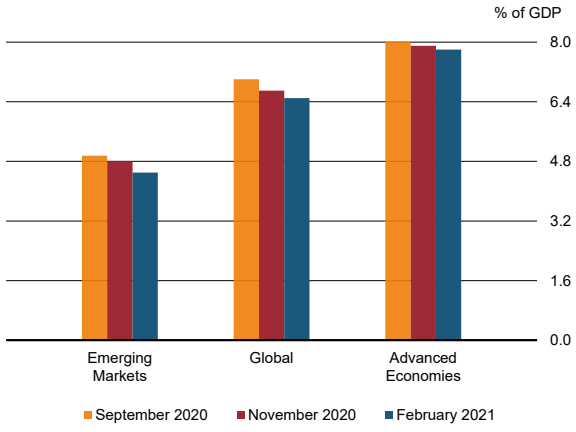
Statistical annex

The Systemic Risk Analysis (SRISK),[4] which is a systemic risk indicator that measures the FI's capital shortfall in a global stress event, increased during the pandemic, but has been decreasing in recent months. At first, stock prices losses reduced FI market capitalization, while the increase in credit supported by governmental programs increased leverage, increasing the level of capital necessary to deal with extreme events (Charts 1.1.2 and 1.1.3). More recently, the recovery of financial sector stock prices contributed to reducing the capital shortfall.

3 In section 1.1 Liquidity, the scope of the analyses is the banking system, comprised of commercial or universal banks, savings institutions, foreign exchange brokers, investment banks, and financial conglomerates including at least one of these types of institutions; in Sections 1.3, Profitability and 1.4 Solvency the scope of the analysis is the prudential conglomerate (as defined by the Resolution no. 4,280, of October 31, 2013, to which the minimal capital requirements have applied since January 1, 2015, according to the Resolution no. 4,193, of March 1, 2013); in Section 1.5 Capital Stress Test, the scope is also the prudential conglomerate, including development banks; and, in Section 1.2 Credit. the scope is the National Financial System (SFN).

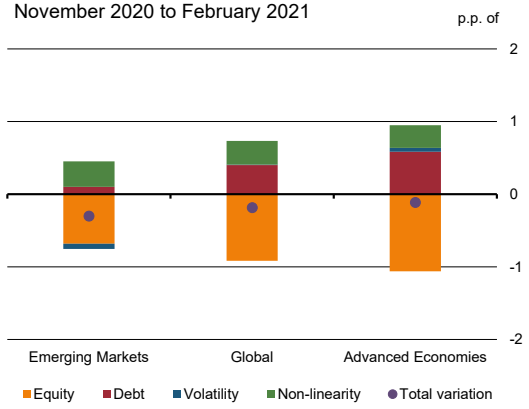
4 The Systemic Risk Analysis (SRISK) is a proxy for the capital shortfall of the financial system, given a permanent 40% drop in the broad global equity index (MSCI Global). To compute the SRISK, the BCB uses public data from FIs listed on stock exchanges across the world. The index does not represent the regulatory capital requirement that result from official stress tests conducted by central banks. Both the methodology and the data used in SRISK are very different from those used in official stress tests. Formally, SRISK (i, t) = max {0; required capital - bank capital}, where required capital = k (D (i, t) + (1-LRMES (i, t)) * W (i, t) and bank capital = (1-LRMES (i, t)) * W (i, t), where k = minimum capital requirement, W (i, t) = market capitalization or market value of the bank, D (i, t) = book value of the total liability of bank i, LRMES (Long-Run Marginal Expected Shortfall) = expected loss of a conditional shock in the market (stock market falls at least 40% in the next 6 months) = -E (R (i, t + 1: t + h) | Rmerc, t + 1: t + h <C), where R (i, t + 1: t + h) is the stock return of bank i in period t + 1 to t + h and Rmerc is the market return (in this case, a 40% drop in MSCI Global).

Chart 1.1.2 – *SRISK (Systemic Risk Analysis)*



Statistical annex

Chart 1.1.3 – Decomposition of the change in SRISK/GDP[1/]
November 2020 to February 2021

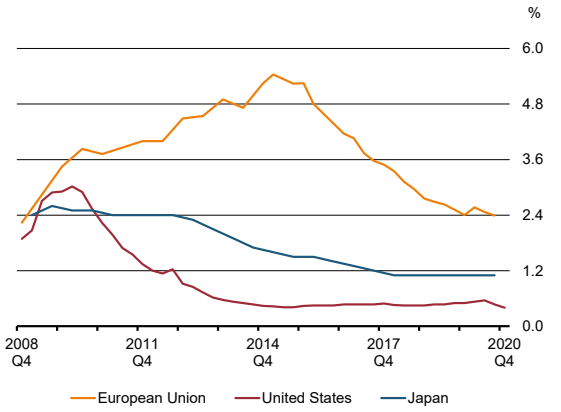


1/ Negative values indicate a reduction in systemic risk.

Statistical annex

Bank credit default indicators of the largest economies do not show a deterioration in the quality of credit portfolios. This is partly due to the programs to support employment, income, and economic activity implemented in response to the economic effects of the pandemic. In advanced economies, another relevant factor are tighter lending standards, as FIs favor borrowers with higher credit scores (Charts 1.1.4, 1.1.5 and 1.1.6).

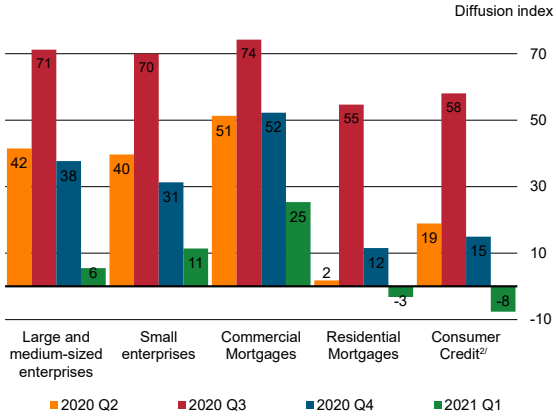
Chart 1.1.4 – Percentage of non-performing loans – *NPL ratio*[1/]



1/ Ratio of delinquent loan stock to total loans.
Source: Bloomberg. Latest data available: US, Q4 2020; European Union and Japan, Q3 2

Statistical annex

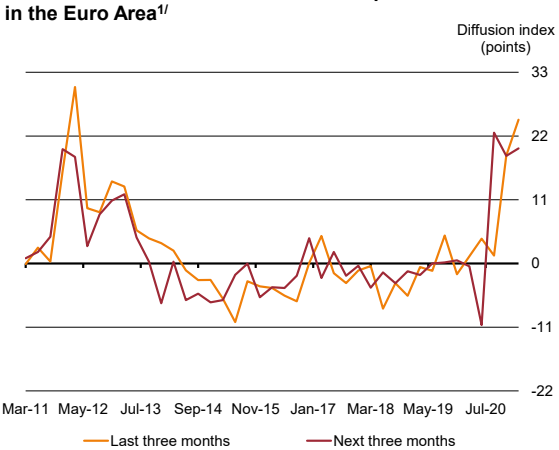
Chart 1.1.5 – US: Bank Lending Conditions[1/]



1/ *Senior Loan Officers Survey* (*Federal Reserve*). Net percentage of respondents tightening credit conditions. 2/ Excludes credit card.

Statistical annex

Chart 1.1.6 – Credit standards for enterprises in the Euro Area[1/]



1/ The higher the index, the tighter the credit conditions.
Source: Bloomberg

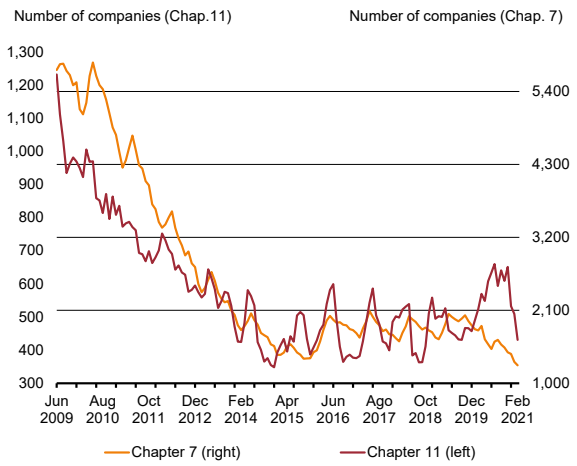
Statistical annex

Governmental measures supported the supply of credit, mostly to companies, and more specifically in the early quarters of the crisis. Several jurisdictions implemented programs aimed at facilitating financing to non-financial firms, such as guarantee schemes, in addition to also temporarily easing bank regulatory requirements.

Government programs helped firms balance their cash flows, increasing indebtedness in the non-financial private sector. Pressed by the need to balance cash flows and stay afloat, some non-financial firms benefited from favorable funding conditions resulting from more accommodating monetary policy conditions and various government programs. Many firms accessed credit lines to precautionarily strengthen their liquidity positions in the face of heightened economic uncertainty, especially at the outset of the pandemic. As a result, the non-financial private sector starts 2021 with a level of indebtedness above pre-crisis.

Prospectively, maintaining low levels of credit default and bankruptcy ratios, important factors to preserve the resilience of the financial system, will depend upon the speed of economic recovery. In some jurisdictions, for instance, in Spain, there has been marginal increase in the number of bankruptcy filings above pre-pandemic levels. In many others, bankruptcy filings continue well below historical levels. This is partly due to temporary regulatory measures that prevent bankruptcy filings by creditors during the pandemic (Charts 1.1.7, 1.1.8 and 1.1.9).

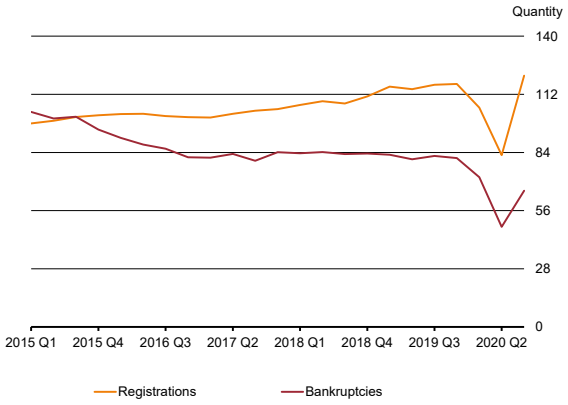
Chart 1.1.7 – US: Bankruptcies, Chapters 7 and 11
3-month moving average



Source: American Bankruptcy Institute

Statistical annex

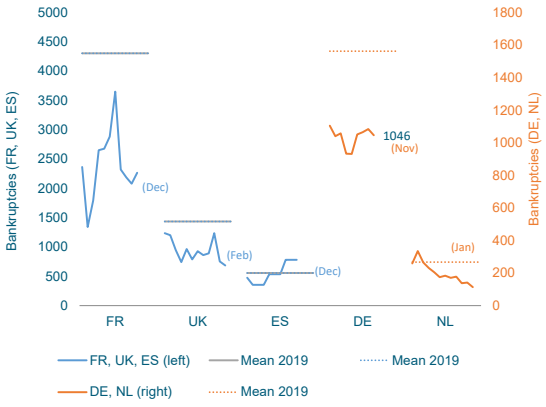
Chart 1.1.8 – Registrations of new businesses and declarations of bankruptcies in the Euro Area



Source: Bloomberg

Statistical annex

Chart 1.1.9 - Euro area - Bankruptcies
March/20 to January/21

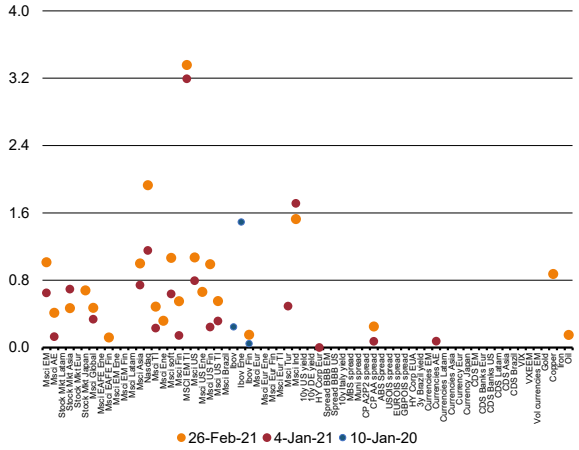


Sources: INSEE, ONS, INE, Destatis, CPS

Statistical annex

Ample global liquidity and better prospects of recovery in advanced economies, especially after the announcement of substantial fiscal stimulus packages in the US, contributed to putting pressure on several financial asset classes. As the uncertainty about the outlook of global activity remains elevated and heavily influenced by the evolution of the pandemic, higher probability is attached to the occurrence of high volatility events in asset prices which could have financial systems facing relevant losses. In some assets' classes, such as global stock and commodities indexes, prices are in the tails[5] (above the 95th percentile or below the 5th percentile, depending on the type of asset)[6] of their distributions conditioned on a market stress scenario - represented by the 10-year US yield curve (Chart 1.1.10 and Table 1.1.1).

Chart 1.1.10 – Asset Prices
Tail risk (P<5 or P>95)



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

Statistical annex

Table 1.1.1 – Asset prices – Tail risk
Price <P5 or >P95

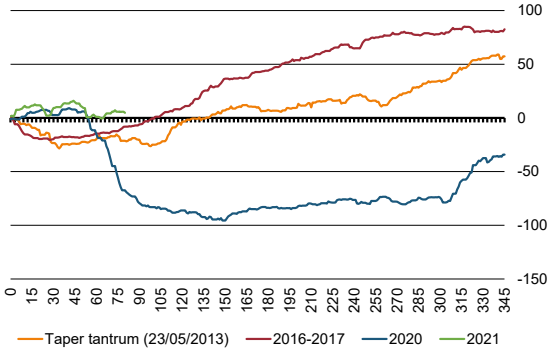
Type of asset	Total	In the tail		
		10-Jan-20	4-Jan-21	26-Feb-21
Equity	33	3	15	19
Interest rates and spreads	16	0	2	1
Currencies, CDS and vol.	15	0	1	0
Commodities	4	0	0	2
Total	68	3	18	22

Sources: Bloomberg, Datastream and FRED St Louis. Calculation: Banco Central do Brasil.

Statistical annex

Intense and sudden changes in asset prices can have negative effects on investment flows to emerging market economies. In the beginning of 2021, strong revisions on the prospects for the US economic recovery – together with concerns about a persistent increase in US inflation – intensified steepening shifts in the US Treasury yield curve, reverberating to a lesser extent to other countries. Past episodes of abrupt changes in the US yield curve were followed by persistent net capital outflows from emerging market economies. The net inflows of foreign capital into emerging market economies in 2021 is partly due to a reversal of the strong net outflows seen in the aftermath of the pandemic outbreak (Chart 1.1.11).

Chart 1.1.11 – Cumulative Daily Capital Flows for Emerging Markets,* US$ bi



* Total flows to: United Arab Emirates, South Africa, Brazil, Korea, Philippines, India, Indonesia, Malaysia, Mexico, Pakistan, Sri Lanka,Thailand, Taiwan, Ukraine, and Vietnam. Source: Bloomberg. Calculation: Banco Central do Brasil.

Statistical annex

5 The distributions were obtained from quantile regressions. The tail risk is measured as the distance between the observed (actual) asset price at a certain date and the price forecasted by a quantile regression for the 5th or the 95th percentiles. For each asset, the relevant tail can be the one with prices below the 5th percentile or above the 95th percentile. The quantile regressions (5th and 95th percentiles) are estimated separately for each asset price series, using as regressors an autoregressive component and the US 10-year yield curve, used as a proxy for markets' stress level. All the series used in the regressions went through a Hodrick-Prescott filter to remove their trend components and were then normalized.

6 For some assets, the relevant tail risk corresponds to prices below the 5th percentile of the distribution conditional upon the US 10-year yield curve. For others, it corresponds to prices above the 95th percentile.

1.2 Financial system overview[7]

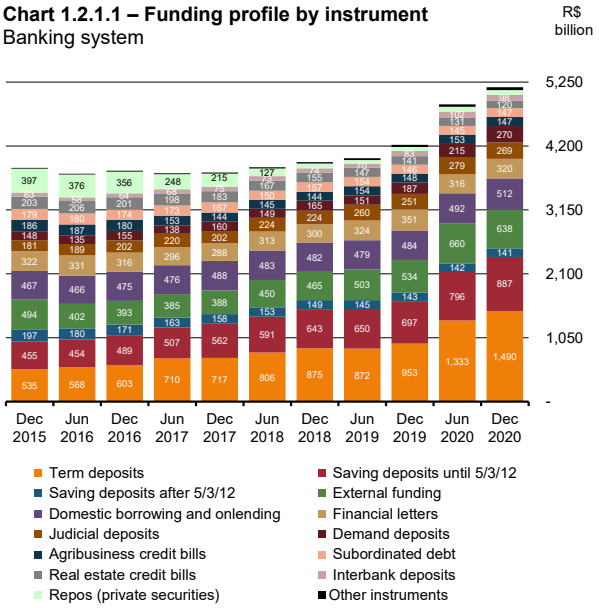
1.2.1 Liquidity

The banking system liquidity is at a high level, with no restrictions to its operations and to supply the demand for credit. Short-term liquidity remains high, reflecting larger volumes of liquid assets, despite the recent increase in its carrying cost. Long-term liquidity remained at a comfortable level. The current funding structure is enough to support long-term assets, even considering the growth in credit granting and the shortening funding periods verified in the last semester. The BCB assesses that the Brazilian banking system has adaptability to suit changes in progress, redefining funding strategies, investing and liquidity management.

Domestic and external funding

Despite a strong pace of growth in the stock of funding instruments in 2020 as a whole, it has slowed down during the second half. Although the portfolio grew by 22% in the year, due to economic agents' resolve to keep liquidity, as commented in the previous edition of the REF, in the last two months the pace of stock growth was lower than that observed in 2019. Throughout 2020, the retraction in funding from institutional investors, mainly from financial letters held by investment funds, was more than offset by the growth of the portfolios of other types of investors (Charts 1.2.1.1 and 1.2.1.2).

Chart 1.2.1.1 – Funding profile by instrument
Banking system

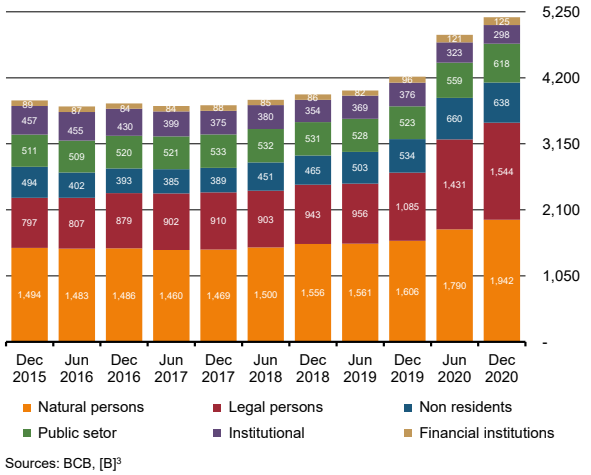


Sources: BCB, [B][3]

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.

Statistical annex

Chart 1.2.1.2 – Funding profile by type of investor
Banking system



Sources: BCB, [B][3]

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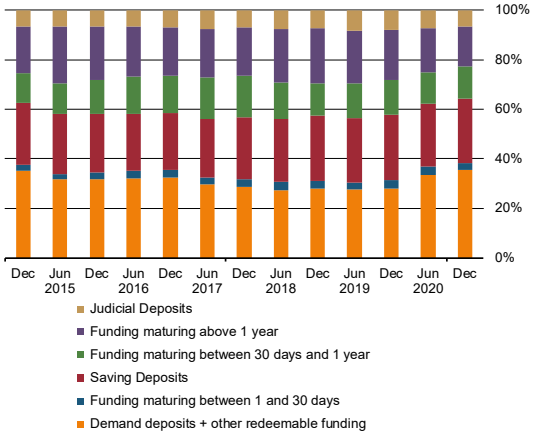
The increase in funding through instruments that can be withdrawn at any time caused the shortening of funding maturities. Inventories of demand deposits, savings deposits and time deposits redeemable at any time are among those that have grown the most over the year, increasing their respective shares in total funding. This shortening results

7 In section 1.1 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 1.3 Profitability and 1.4 Solvency, the scope of the analyses is the prudential conglomerates related to the banking system, as defined by Resolution no. 4,280, from October 31, 2013, to which the minimal capital requirements, as stated by Resolution no. 4,193, from March 1, 2013, are applied since January 1, 2015. In section 1.5 Capital stress tests, the scope is the latter including the prudential conglomerates involving development banks. In section 1.2 Credit, the scope is the whole National Financial System (SFN).

in the need for greater volumes of liquid assets available to cope with a greater likelihood of possible withdrawals. (Chart 1.2.1.3).

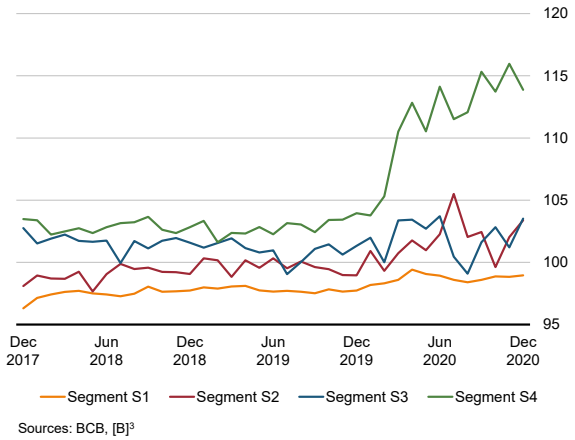
In 2020, average funding interest rates increased in relation to the interbank deposit rate. Although the nominal funding rates have fallen over the year, following the downward trend for the basic interest rate (Selic), the monthly average funding rates expressed in terms of the interbank deposit interest rate increased in the first half and have remained at an approximate constant (albeit high) level since then – except for the S4 segment, whose rates have kept a persistent upward trend throughout the year. This movement reflects a search-for-yield behavior by investors, driven by a low interest rate scenario (Chart 1.2.1.4).[8]

Chart 1.2.1.3 – Domestic funding
Residual maturity profile



Statistical annex

Chart 1.2.1.4 – Monthly average funding rates (*)



Sources: BCB, [B][3]

(*) 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.

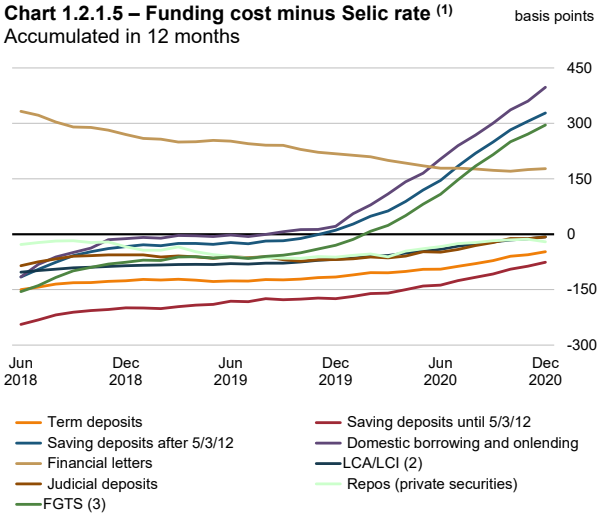
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The average funding cost has exceeded the banking system yield obtained with liquid assets. Low interest rates in 2020 have sparked a search-for-yield behavior by investors, leading to a rise in funding costs above the basic interest rate (Selic), mainly due to the increased influence of fixed income or fixed spread (in relation to the interbank deposit rate) securities on the composition of average rates. This movement results on a higher cost in keeping liquidity within the banking system, since liquid assets' yields tend to be closer to the Selic rate, and thus lower than those of fixed income or fixed spread securities. Additionally, funding instruments whose interest rates are subject to regulations have also been pressuring the average funding cost[9] (Charts 1.2.1.5, 1.2.1.6 and 1.2.1.7).

8 The acronyms S1 to S4 designate the segments of financial institutions and other institutions authorized to operate by the BCB for proportional application of prudential regulation, according to Resolution 4,553, as of January 30, 2017.

9 Savings deposits until 5/3/2012, Guaranteed Fund for Length Service (FGTS) and Domestic borrowing and on lending.

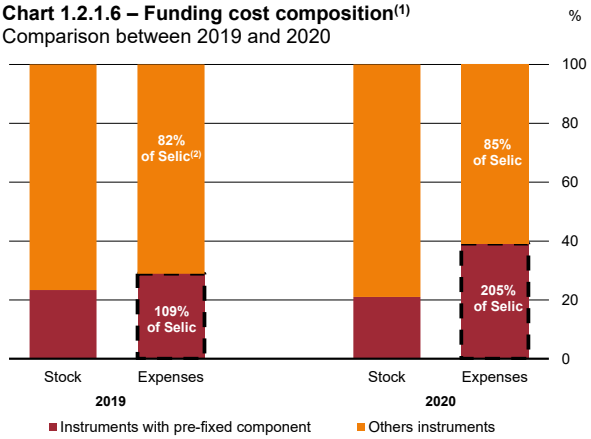
Chart 1.2.1.5 – Funding cost minus Selic rate (1)
Accumulated in 12 months



(1) Estimate based on accounting data of the five largest banks in the system.
(2) Agribusiness and real estate credit bills.
(3) Guaranteed Fund for Length Service.

Statistical annex

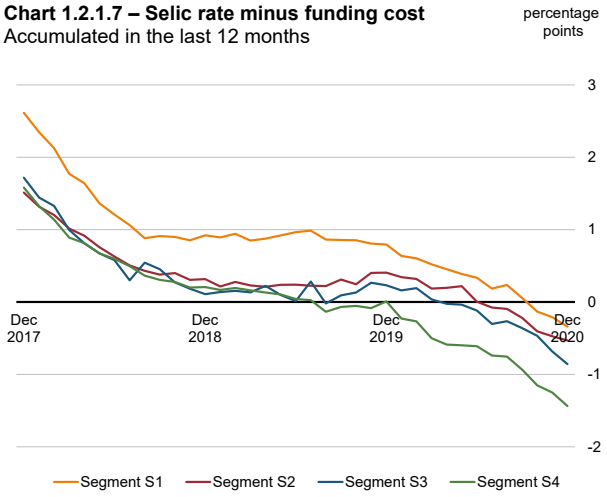
Chart 1.2.1.6 – Funding cost composition(1)
Comparison between 2019 and 2020



(1) Estimate based on accounting data of the five largest banks in the system.
(2) Selic rate accumulated in the period.

Statistical annex

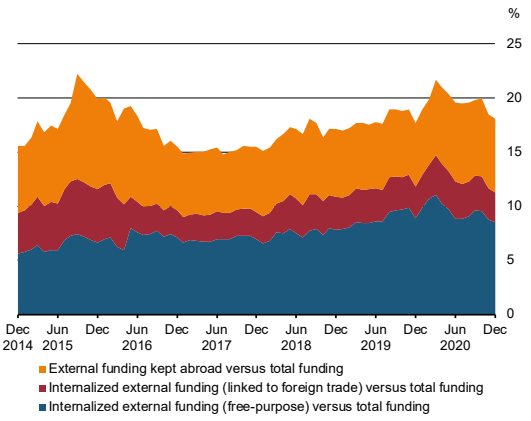
Chart 1.2.1.7 – Selic rate minus funding cost
Accumulated in the last 12 months



Statistical annex

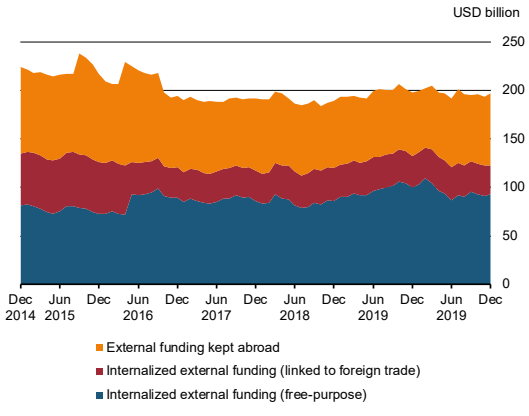
The external funding balance remained relatively stable in the second half of 2020. The risk of funding constraints from foreign markets remains low. The balance, when expressed in U.S. dollar, has remained stable since 2017 with values around an average of US$194 billion. The share of total borrowings fluctuated due to the volatility of the exchange rate (Charts 1.2.1.8 and 1.2.1.9).

Chart 1.2.1.8 – Profile of external funding
As a percentage of total funding



Statistical annex

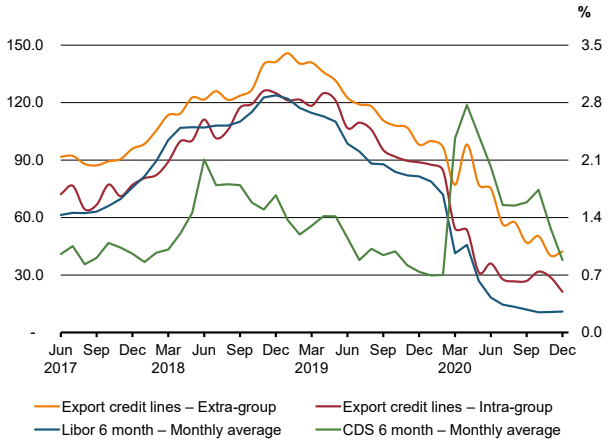
Chart 1.2.1.9 – Profile of external funding
Absolute amounts in dollars



Statistical annex

The balance of export-linked external credit lines decreased in 2020, despite the reduction in costs. The cost of export-linked external credit lines fell due to the sharp drop in international reference rates (Chart 1.2.1.10). However, demand for export financing in the form of ACC/ACE[10] fell sharply from April 2020. These modalities competed with domestic financing lines, which became cheaper due to the reduction in the Selic rate, exemption from the Tax on Financial Operations (IOF) and liquidity expansion policies adopted throughout the pandemic.

Chart 1.2.1.10 – External credit lines for export
Interest rates



Statistical annex

Short-term liquidity

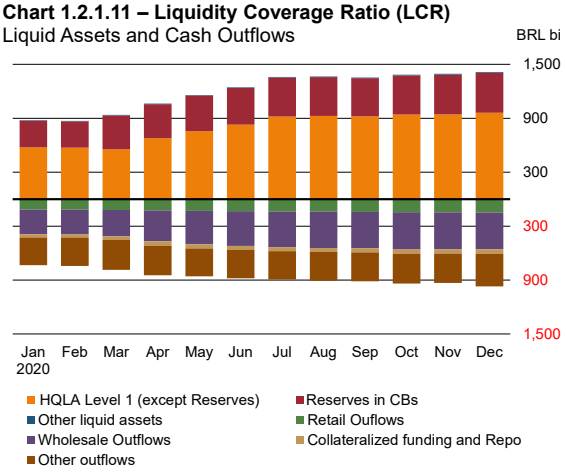
Short-term liquidity remains at a high level in the entire banking system. Funding instruments, such as DPGE and LTEL-LFG, ensured funds for financial intermediation in smaller banks. For banks in the S1 prudential segment, the highly liquid assets available raised, driven by the increase in funding, more than offsetting the growth in cash outflows estimates (Chart 1.2.1.11). Cash inflows were slightly reduced, still reflecting the deferral resulting from the restructuring and renegotiation of credit operations in the 1st semester, as well as the grace periods of the emergency credit programs. This has resulted in a drop at the level of the Liquidity Coverage Ratio (LCR)[11] along the semester (Chart 1.2.1.12), remaining, however, well above (229%) the minimum requirement of 100%. For all financial institutions, the short-term liquidity ratio (IL) [12] – which considers stress scenarios – increased, ending the semester at 2.86 (Chart 1.2.1.13), with a relevant portion of the banking system having comfortable levels of liquidity (Chart 1.2.1.14).

10 The foreign exchange transactions related to exports may be carried out with a future settlement date (on account of future receipt of the foreign currency paid by the overseas importer), but with the advance of the national currency, by the bank, to the exporter. This advance aims at providing the exporter with the capital necessary to finance its industrial or commercial cycle. When the exporter receives the national currency before the goods are shipped, it is called ACC; in cases where the receipt occurs after shipping, it is called ACE.

11 The LCR is an index whose compliance is mandatory for all financial institutions in the S1 segment, pursuant to art. 2 of Resolution 4,553, of January 30, 2017. The indicator requires institutions to maintain high liquid assets to support cash outflows in the next 30 days, considering the stress scenario defined by the Basel Committee on Banking Supervision (BCBS) (www. bis.org/publ/C238.htm). Domestic regulation by CMN Resolution 4.401, of February 27, 2015, and by BCB Circular 3,749, of March 5, 2015.

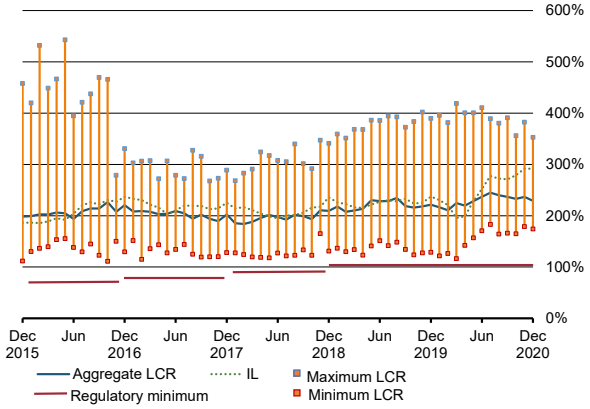
12 The IL - which covers the entire SFN - measures whether banks have enough liquid assets to cope with their short-term cash-flow needs in a simulated stress scenario (period of 21 business days) defined and calibrated by the BCB. The cash outflows arise from the run-off of maturing or redeemable liabilities, losses from market risk exposures, for instance, margin calls and settlements of derivatives, and others contractual payables over the next month. Institutions with IL above 1 have enough liquid assets to face those cash outflows. For further details about this indicator, please refer to Stress Test Section of this report.

Chart 1.2.1.11 – Liquidity Coverage Ratio (LCR)
Liquid Assets and Cash Outflows



Statistical annex

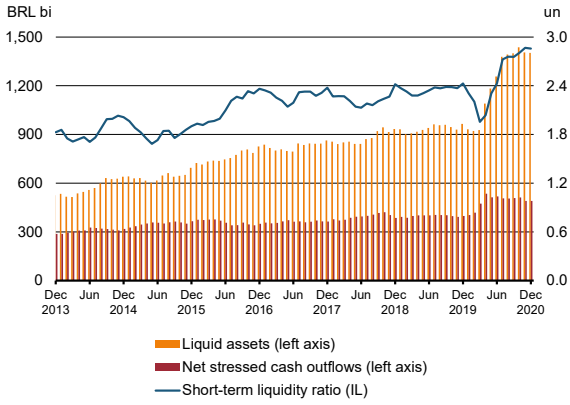
Chart 1.2.1.12 – LCR
High, low and aggregate[1/]



1/ Until Sep18: aggregate LCR and IL series comprise banks with more than BRL 100 bi in total assets. From Oct18 on: encompass banks in the S1 Segment.

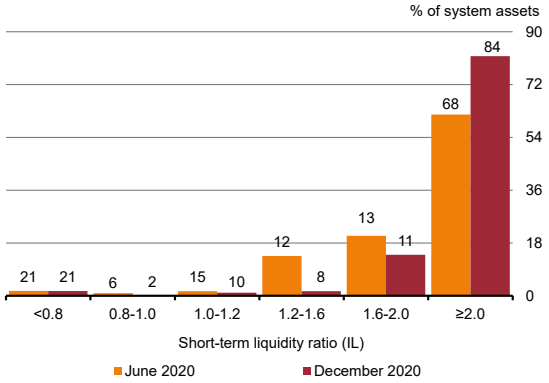
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Chart 1.2.1.13 – Short-term liquidity ratio (IL)



Statistical annex

Chart 1.2.1.14 – Short-term liquidity ratio (IL)
Frequency distribution[1/]

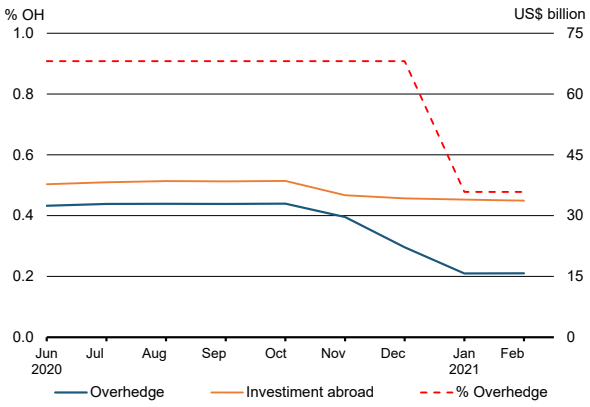


1/ The numbers above bars are the number of financial institutions with IL within the corresponding interval.

Statistical annex

The reduction in the need of overhedge mitigates the pressure on liquidity. Due to divergences in the tax treatment, the exchange variation of investment abroad (IA) hedge should be higher than the value of the IA to neutralize the effects of exchange rate volatility on profitability. This surplus is usually called an overhedge. Law 14,031, of July 28, 2020, eliminated these divergences, producing their effects in two steps. At the end of December 2020, the first phase resulted in a reduction in the value of the hedge in the order of USD13 billion (Chart 1.2.1.15). This movement reduces the need of liquidity maintenance as financial institutions are less likely to payment of daily settlements and margin calls to maintain their positions.

Chart 1.2.1.15 – Overhedge & investiment abroad

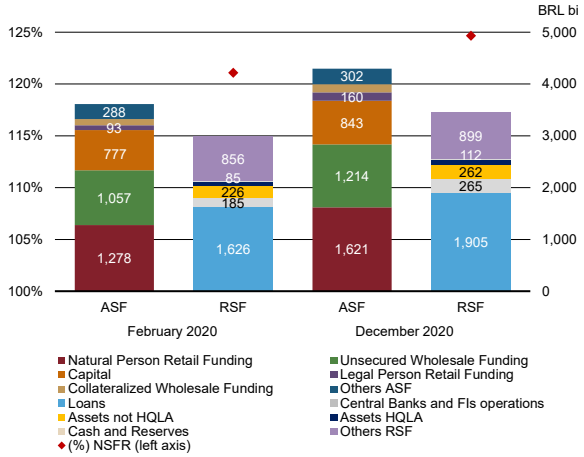


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Long-term Liquidity

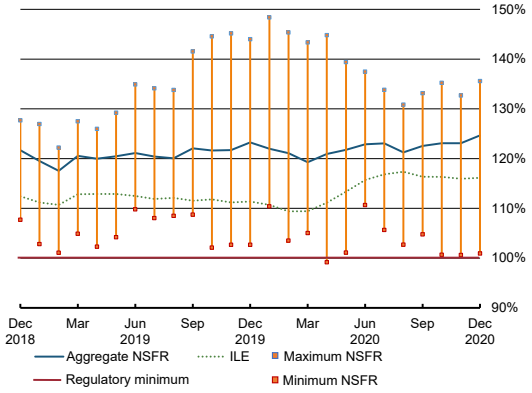
The funding structure remains at an adequate level for long-term assets financing. Long-term funding sources raised in the period, mainly in private banks. The funding increase and the strengthening of capital levels, stimulated by the restriction on profit distributions, led to the growth of financing sources, especially retail funding, considered stable, such as demand deposits and saving accounts (Chart 1.2.1.16). These funds were enough to support long-term credit growth, with an emphasis on emergency credit programs and modalities such as real estate loans, stimulated by low interest rates. The regulatory indicator NSFR,[13] observed by banks of the S1 prudential segment, increased in the semester, reaching 124.7% (Chart 1.2.1.17), expanding the gap to the regulatory minimum of 100%. The Structural Liquidity Ratio (ILE),[14] which covers the entire SFN, ended the semester at 1.17 (Chart 1.2.1.18), with most of the banking system having adequate level of resources on its balance sheets (Chart 1.2.1.19).

Chart 1.2.1.16 – Net Stable Funding Ratio Structure (NSFR)



Statistical annex

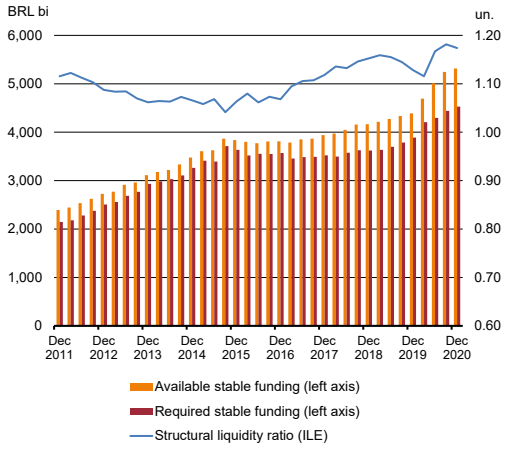
Chart 1.2.1.17 – NSFR
High, low and aggregate[1/]



1/ NSFR and ILE series comprise FIs in the Segment S1 (nowadays: 6 banks).

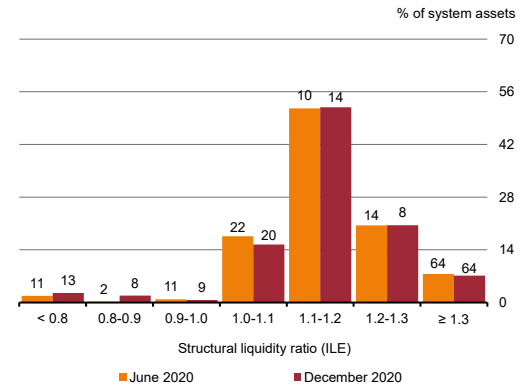
Statistical annex

Chart 1.2.1.18 – Structural liquidity ratio



Statistical annex

Chart 1.2.1.19 – ILE Frequency distribution[1/]



1/ The numbers above bars are the number of financial institutions with ILE within the corresponding interval.

Statistical annex

13 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, having started its effects from October 1, 2018. It is a ratio that has a minimum regulatory amount of 100% and the compliance is mandatory for all financial institutions in the S1 segment, according to art. 2 of Resolution 4,553, of January 30, 2017.

14 ILE aims to measure whether banks have enough stable funding resources (numerator) to finance their long-term activities (denominator). Thus, institutions with ILE equal to or greater than 1 are less susceptible to future liquidity problems. For details, see appendix Concepts and Methodologies, item b

1.2.2 Credit

Introduction

Emergency credit programs and low interest rates set the profile of credit growth in the semester. In response to the shock of the pandemic, emergency credit programs have driven growth in the MSME segment. In the household segment, real estate credit with savings funds was the highlight.

The performance of modified loans has been better than expected. One of the measures to deal with the crisis was to allow payments for operations with economically healthy counterparts to be postponed. Most of the operations that were modified during the crisis are already out of the grace period and have been showing payment levels higher than originally expected.

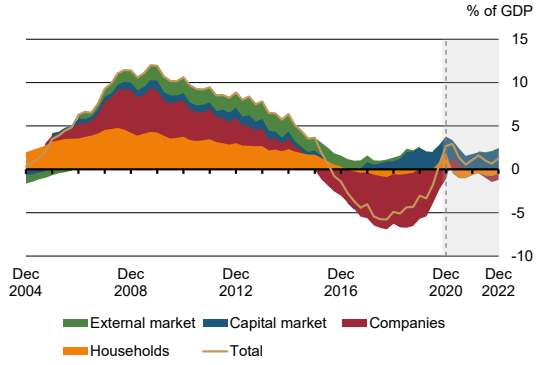
The SFN provisions are enough to support expected credit losses. The provisions set up by FIs increased during the crisis and reached the highest historical percentage in relation to problem assets. The SFN provisions are higher than the losses estimated by BCB for the credit portfolio, even considering modified loans.

However, given the uncertainty above than the usual about the evolution of the economic scenario, credit losses may be higher than the estimated levels. The high level of uncertainty about the effects of the end of the emergency measures and the extension of the pandemic on income, employment and business activity makes it difficult to make a reliable assessment of the prospective framework of credit quality and losses for the SFN. The increase in provisions made by FIs, the improvement in capitalization and the restriction on dividend distribution in 2020 form significant barriers to deal with these uncertainties (such perspective is corroborated by the stress tests - see section 1.5).

Broad credit and long run trend

Broad credit grew without excesses in 2020. The different types of credit that make up broad credit (bank credit, external credit and capital markets) showed growth consistent with the stimuli and the economic environment of the period. The increase in the broad credit-to-Gross Domestic Product (GDP) gap seen in 2020 was mainly due to the recent drop in GDP and the growth in corporate portfolio related to emergency credit programs. In 2021, however, considering the projections for GDP growth and the behavior of broad credit, a reversal of this trend is expected (Chart 1.2.2.1).

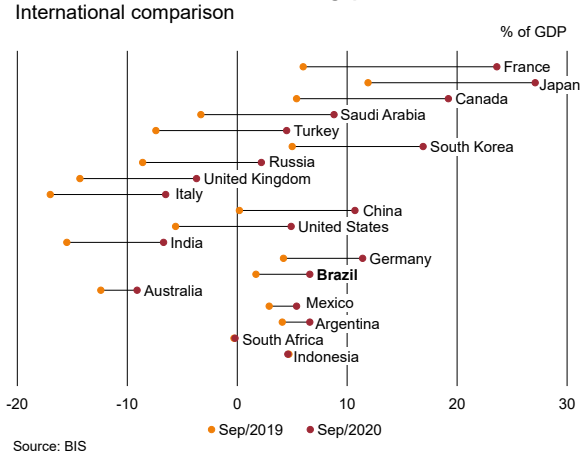
Chart 1.2.2.1 – Broad credit/GDP gap – Without FX variation
Shaded area: forecast



Statistical annex

Due to the pandemic, an increase in the broad credit-to-GDP gap15 was observed worldwide. The variation of this indicator in other countries exceeds that observed in Brazil in the period between September 2019 and September 2020 (Chart 1.2.2.2).[16] Such increases are due both to larger drops in GDP and to emergency credit programs adopted by several of these countries.

Chart 1.2.2.2 – Broad credit/GDP gap
International comparison



Source: BIS

Statistical annex

Companies

Bank credit was the outstanding source of funding to companies in the semester, but there is uncertainty about the risk of this portfolio for 2021. External market funding, as well as capital market funding, was low, because it is tied to the behavior of the macroeconomic scenario. The growth of 31% in bank credit to MSMEs[17] in the second half of 2020 was driven by government programs. This double digit six-month growth is not expected to be repeated in the first half of 2021.

The economic and financial situation of the companies has improved, but in an uneven way, and the degree of uncertainty is still high. In listed companies, medians for return on equity and payment capacity rebounded in the second half of 2020 (Chart 1.2.2.3).[18] In a more comprehensive view, considering all companies[19], the inflow shows an upturn in several economic sectors (Table 1.2.2.1), but sanitary restrictions still negatively impact some sectors, such as "Media and Leisure"[20] and "Transport". Additionally, the differences in performance of the various companies widened, as the dispersion of the variations in the companies' inflows increased in most sectors from the first quarter of 2020 to the other quarters. The improvement trend, therefore, should be analyzed carefully, since there is uncertainty about the extension of the pandemic and its economic ramifications.

15 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*.

16 The broad credit-to-GDP gap calculated by the BIS is affected by exchange rate variation, so the values for Brazil differ from those shown in Chart 1.2.2.1.

17 For companies' size definition, see Concepts and Methodologies Annex, item *j*.

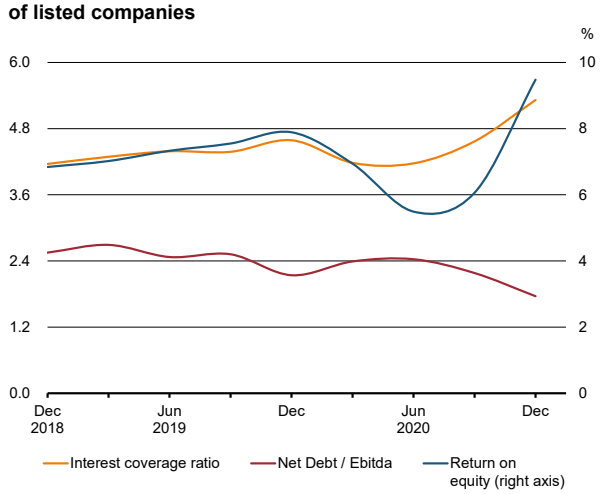
18 The calculations of the indicators for listed companies are: i) Interest coverage ratio: Ebitda/net financial expenses, both accumulated for the last twelve months; ii) Net Debt/Ebitda: net debt refers to the quarter in question and Ebitda is accumulated for the last twelve months; iii) Return on equity: Net Income /Equity (average), where net income is the sum of the last twelve months and the equity is the average over the last year.

19 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.

20 The "Media and Leisure" sector includes restaurants, bars and similar establishments, hotels, travel agencies, and services for organizing fairs, congresses, and parties, among others.

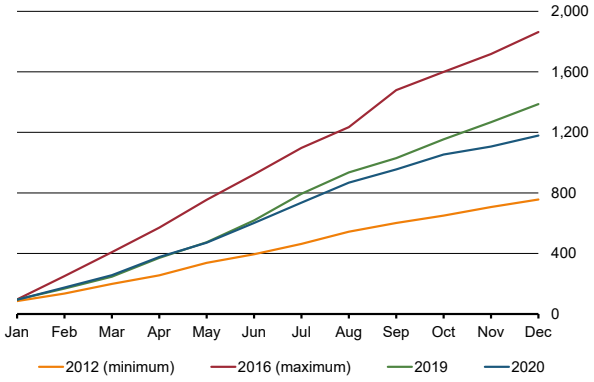
Judicial recovery requirements were below that of the previous year, contained by measures to deal with the pandemic. Access to emergency credit programs and stimulus packages, as well as the willingness to renegotiate with creditors, positively impacted the number.[21] In 2021, with the extension of the pandemic and the uncertainty regarding the recovery of the economy, the number of judicial recovery requirements may rise (Chart 1.2.2.4).

Chart 1.2.2.3 – Economic and financial indicators of listed companies



Statistical annex

Chart 1.2.2.4 – Corporations in judicial recovery
Cumulative requests by year



Source: Serasa Experian

Statistical annex

Table 1.2.2.1 – Variation of the companies' inflows
Quarterly average (current quarter/year average x previous quarter/year average)

Sector	Micro, Small and Medium					Large				
	mar/20	jun/20	sep/20	dec/20	mar/21[1]	mar/20	jun/20	sep/20	dec/20	mar/21[1]
Public administration and NGOs	5%	-7%	0%	4%	4%	14%	-2%	3%	15%	-2%
Agriculture	20%	24%	31%	29%	46%	30%	33%	17%	21%	28%
Food	13%	11%	21%	25%	33%	14%	16%	15%	24%	30%
Automotive	6%	-21%	7%	25%	36%	-2%	-50%	-21%	3%	-3%
Beverages and tobacco	12%	4%	22%	28%	27%	-10%	-13%	15%	12%	4%
Construction, wood and furniture	14%	-1%	18%	29%	36%	1%	-13%	16%	31%	21%
Animal production	18%	14%	32%	39%	44%	14%	8%	19%	32%	23%
Eletric and electronic components	8%	-4%	15%	27%	36%	12%	-10%	29%	59%	41%
Energy	16%	-6%	9%	29%	40%	13%	-5%	25%	18%	17%
Machinery and equipments	11%	-5%	8%	32%	38%	18%	4%	19%	33%	28%
Media and leisure	9%	-41%	-27%	-6%	-1%	9%	-37%	-36%	-20%	-22%
Pulp and paper	3%	-11%	3%	30%	61%	-4%	-26%	-17%	7%	15%
Petrochemical	20%	-17%	3%	17%	30%	5%	-33%	-9%	0%	7%
Chemicals, pharmaceuticals and hygiene	17%	7%	15%	23%	32%	12%	6%	5%	10%	10%
Health, sanitation and education	18%	-1%	2%	8%	19%	2%	-8%	-11%	0%	5%
Other services	16%	-7%	8%	17%	26%	21%	15%	36%	33%	28%
Metallurgy	7%	-10%	13%	35%	80%	-3%	-29%	1%	18%	50%
Sugar cane	14%	5%	22%	12%	29%	15%	-15%	4%	-1%	-2%
Telecommunications	35%	38%	36%	36%	45%	21%	-26%	-20%	-5%	2%
Textiles and leather	9%	-30%	-11%	9%	19%	2%	-44%	-27%	1%	-2%
Transport	7%	-7%	2%	12%	25%	8%	-22%	-20%	-14%	-13%
Retail	22%	18%	28%	34%	34%	13%	8%	17%	18%	10%
Others	10%	-8%	9%	37%	32%	4%	-4%	24%	17%	0%

Considers: means of payment documents ('boletos'), bank transfers ('TEDs'), debit and credit cards, instant payments ('PIX') and exports.

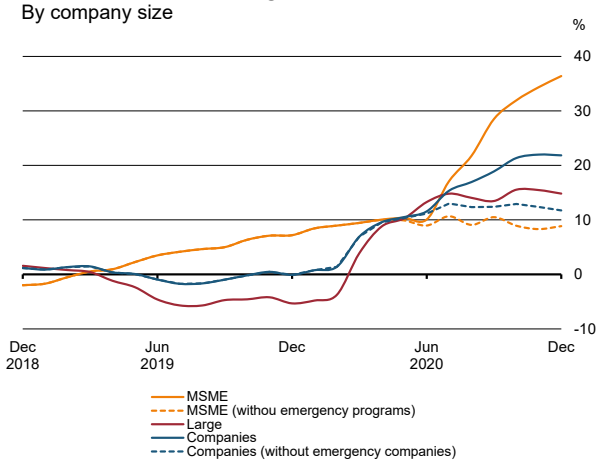
[1] In Mar/21, flow information from more than 4.7 million companies was considered.

Statistical annex

21 Bankruptcy requirements tracked the same trend in 2020.

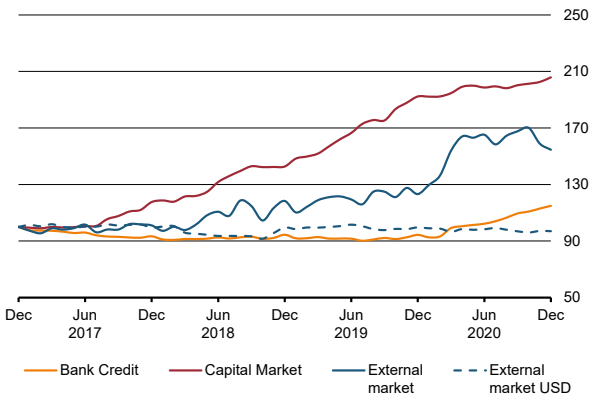
Funding for companies was driven by emergency credit programs[22] for MSMEs. In December 2020, corporate indebtedness surpassed the R$4 trillion mark,[23] with bank credit showing the highest growth rate in recent years. The increase in MSMEs' bank credit balance intensified in the second half of the year due to emergency programs.[24] In the large companies, the annual growth was influenced by significant fund raising by a restricted group of companies in March and April and remained stable in the second half of the year (Chart 1.2.2.5). Financing via capital market[25] slowed down (Chart 1.2.2.6), with bond issuance concentrated in a few companies, and the external market has reduced its relevance as a source of funding for companies.[26]

Chart 1.2.2.5 – YoY credit growth
By company size



Statistical annex

Chart 1.2.2.6 – Corporate indebtedness
Dec/2016 = 100



Statistical annex

The portfolio of problem assets has increased less than the total portfolio. In the MSMEs, the credits considered as problem assets remained stable, but the percentage in relation to the portfolio decreased significantly (Chart 1.2.2.7), mainly due to the increase in the balance coming from emergency programs, in which the risk is mostly from the Federal Government (Chart 1.2.2.8). On the other hand, in large companies, the percentage of PA effectively increased 0.4 p.p. in the second half of 2020, due to the classification of operations with risk between "E" and "H" (Chart 1.2.2.9). In the corporate sector, the PAs portfolio grew 4.3% in the semester, but, given that the total credit grew 12.3%, the overall percentage of PAs fell. However, given the uncertainty about the developments of the pandemic, the credits considered PAs may even increase as a percentage of the portfolio over 2021, since they depend on the macroeconomic scenario.

22 The emergency credit programs considered are: (i) National Program to Support Micro and Small Companies (Pronampe); (ii) Emergency Credit Access Program (FGI - Peac); (iii) Circular 4,033, of June 24, 2020, which established deductions on reserve requirements on savings deposits calculation using credit operations for financing working capital (iv) Emergency Employment Support Program (Pese); (v) Emergency Credit Access Program in the Modality of Guaranteed Receivables (Peac-Maquininhas); (vi) Program of Working Capital for the Preservation of Firms (CGPE).

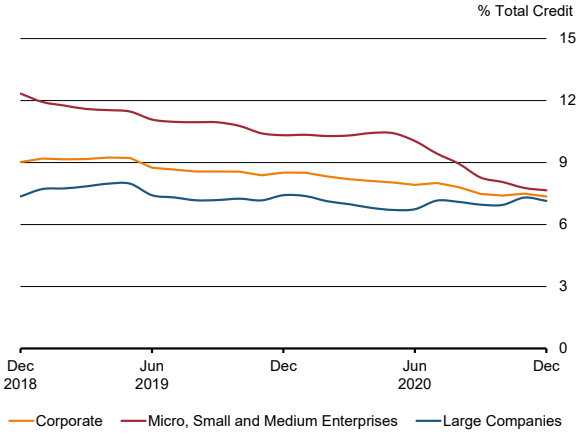
23 Corporate indebtedness growth was 2.5% in the semester and 21.1% in twelve months. Disregarding the exchange rate effect (exchange rate was 4.03 BRL/USD in December 2019, 5.48 BRL/USD in June 2020 and 5.20 BRL/USD in December 2020), corporate indebtedness growth would have been 4.4% for the half year and 9.7% for the year.

24 Disregarding the impact of the emergency credit programs, MSME annual growth would have been 8.8% in December 2020, like the growth experienced in the first half of the year.

25 Bonds and commercial papers.

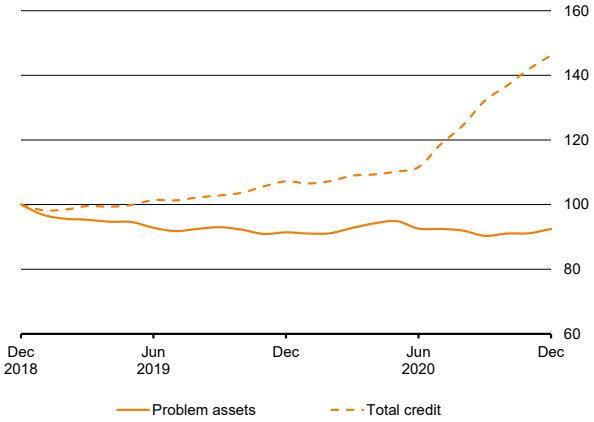
26 Balance reduction of 6.4% in the semester was due to the exchange rate appreciation in the period and the slight reduction in the amount of debt in dollars.

Chart 1.2.2.7 – Problem Assets



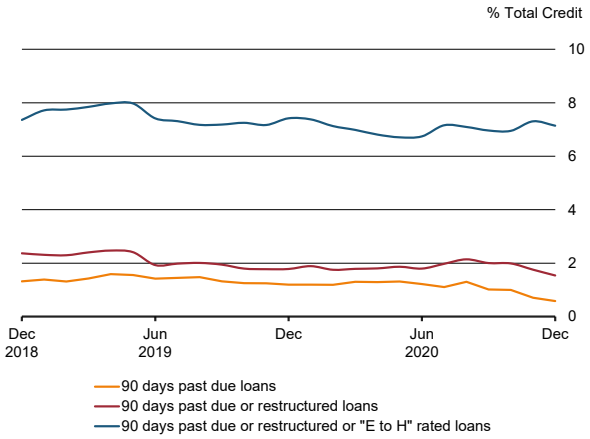
Statistical annex

Chart 1.2.2.8 – Problem Assets
Micro, small and medium enterprises (dec/2018 = 100)



Statistical annex

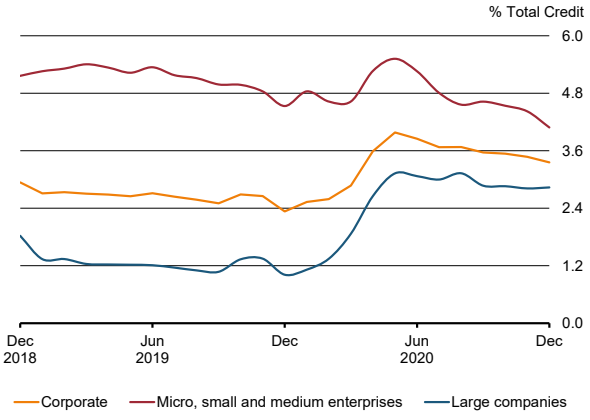
Chart 1.2.2.9 – Problem Assets
Large Companies



Statistical annex

The worsening of portfolio quality was also seen in operations not yet classified as PAs. The pre-PA portfolio increased significantly between March and May and has remained relatively stable since then. This movement occurred especially in large companies and it was related to the classification of operations at risk level "D" (Chart 1.2.2.10). In the case of MSMEs, the drop in the pre-PA percentage is related to the strong increase in the total credit portfolio that occurred in the second half of the year (denominator effect).

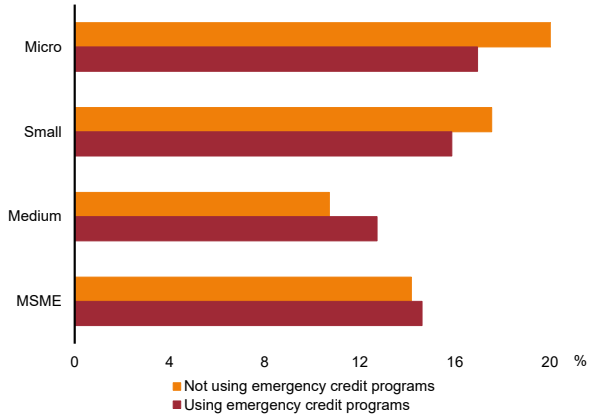
Chart 1.2.2.10 – Pre-problem assets



Statistical annex

The level of risk for borrowers of emergency credit programs is like other borrowers. The MSME portfolio was significantly affected by the emergency credit programs. However, the probability of default (PD)[27] estimated for MSME borrowers that accessed an emergency credit program and for those that did not accessed any program is similar between the two groups (Chart 1.2.2.11). This suggests that the emergency credit programs, *per se*, did not added new risks to the portfolio of micro, small, and medium-sized firms.

Chart 1.2.2.11 – Probability of *default* (dec/20)

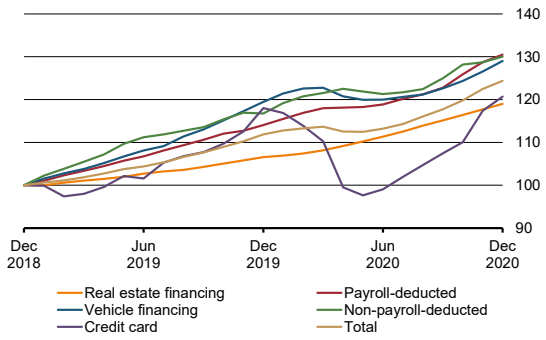


Statistical annex

Households

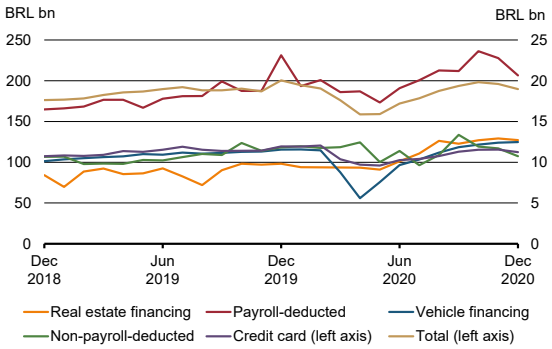
Household credit resumed its growth trend in the second half of the year, with an uncertain prospective trajectory of risk, given the unfolding of the pandemic. After a minor drop in the second quarter of 2020, the portfolio has resumed its previous growth trend, with higher levels of granting compared to the first half of the year (Charts 1.2.2.12 and 1.2.2.13). The economic environment in which this growth occurred showed mixed signals. There was recovery in economic activity and drop in the unemployment rate in the last months of the year, but an increase in the levels of debt service-to-income and indebtedness.

Chart 1.2.2.12 – Household credit facilities
Dec-2018 = 100



Statistical annex

Chart 1.2.2.13 – Deflated and seasonally adjusted credit grants



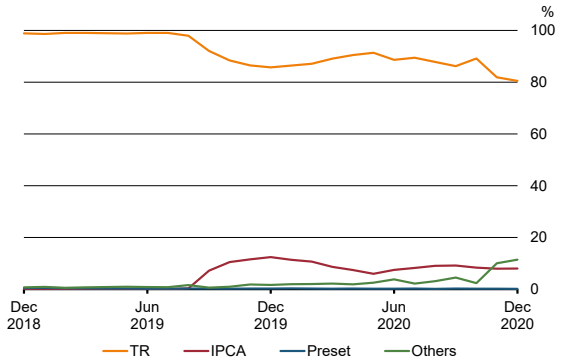
Statistical annex

In 2020, the highlight amongst facilities was real estate financing, whose growth was due to lower interest rates and the use of new indexing factors. The average interest rate for operations granted with the Referential Rate (TR) indexing factor in the Housing Finance System (SFH) line maintained its downward trend in 2020. Operations with

27 The PD model for MSMEs estimates the probability that the borrower will have more than 1% of its portfolio in problem assets over the twelve-month horizon. In the comparison made, already deteriorated borrowers were not considered, i.e. those who already have more than 1% of their portfolio in PA.

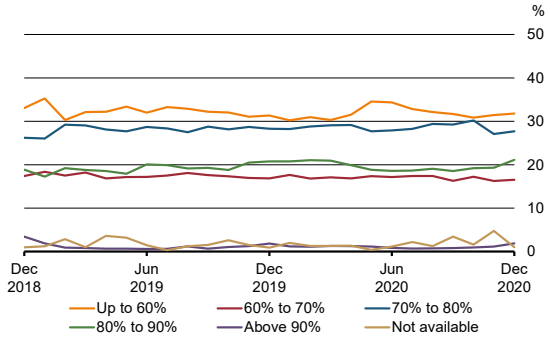
indexing factors as the Extended National Consumer Price Index (IPCA) or the savings account interest rate,[28] both with lower initial installments than those with the TR indexing factor, also contributed to increase the demand for real estate financing (Chart 1.2.2.14). The observed growth occurred without significant changes in the LTV (Chart 1.2.2.15)[29] and term (Chart 1.2.2.16) lending patterns.

Chart 1.2.2.14 – Credit granting by indexing factor



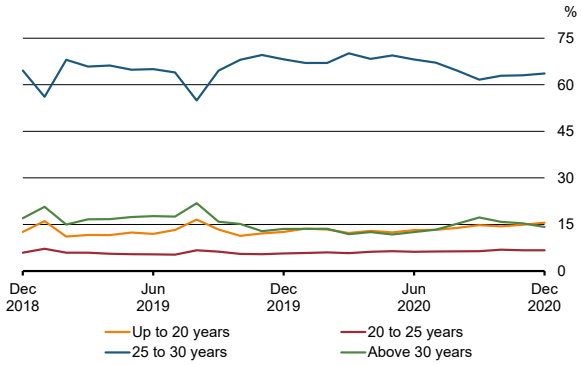
Statistical annex

Chart 1.2.2.15 – Credit granting by LTV
Real estate financing



Statistical annex

Chart 1.2.2.16 – Credit granting by operation term
Real estate financing



Statistical annex

Vehicle financing rebounded in the second half of 2020, resuming the pre-pandemic trend and lending patterns. The volume of grants has returned to the pre-pandemic level (Chart 1.2.2.13). Also, as already analyzed in a previous edition of this Report,[30] the granting criteria for a growing portion of the operations contracted would meet the criteria of Circular 3,515/2010,[31] especially for vehicles older than three years (Chart 1.2.2.17). The average LTV at origination has grown especially for older vehicles (Chart 1.2.2.18), and the average term at origination, after being stable in the third quarter, increased again in the final months of 2020 (Chart 1.2.2.19).

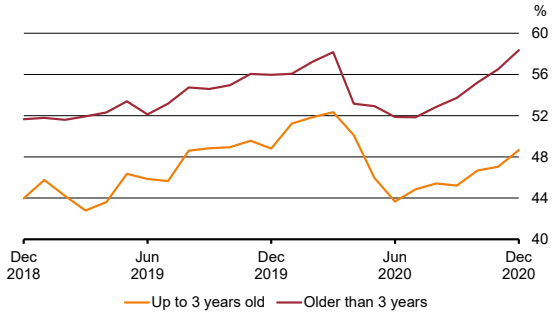
28 In contracts with the savings account interest rate as indexing factor, the interest rate is composed of a fixed part and a variable part, which corresponds to the yield of the savings accounts. In Chart 1.2.2.14, as of the last quarter of 2020, the "Others" indexing factor category is mostly composed of operations with savings as indexing factor.

29 LTV: ratio between the value of the loan and the value of the property, at the time of granting.

30 Refer to Financial Stability Report, April 2020, section 1.2.4, Chart 1.2.4.8.

31 Circular 3,515, of December 3, 2010, which determined higher capital requirements for operations granted with combinations of maturity and LTV considered riskier.

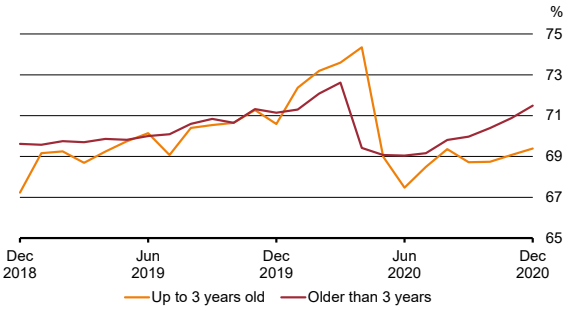
Chart 1.2.2.17 – Percentage of operations contracted that would meet the criteria of Circular 3,515/2010



Source: BCB (SCR) and

Statistical annex

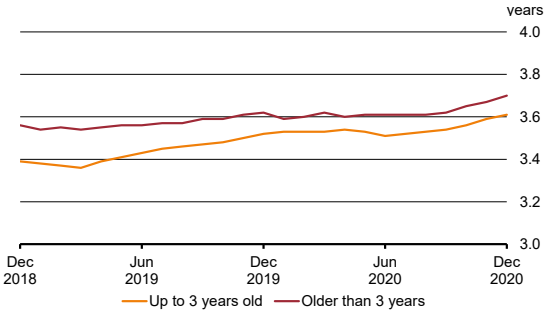
Chart 1.2.2.18 – Average LTV at origination by vehicle age
Vehicle financing



Source: BCB (SCR) and SNG.

Statistical annex

Chart 1.2.2.19 – Average term at origination by vehicle age
Vehicle financing

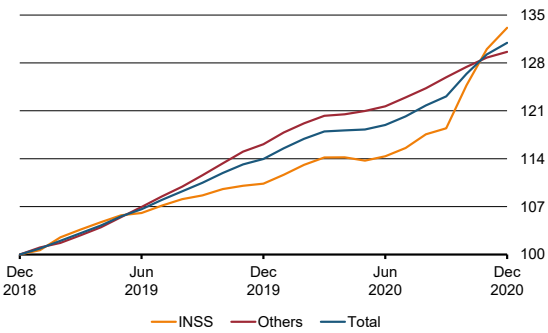


Source: BCB (SCR) and SNG.

Statistical annex

The payroll-deducted credit of retirees and pensioners from the National Institute of Social Security (INSS) showed significant growth in the second half of 2020. This was mainly due to the increase in the maximum deduction percentage to 40%, which allowed new granting in this facility to borrowers who were close to the previous deduction limit (Chart 1.2.2.20).[32]

Chart 1.2.2.20 – Payroll-deducted credit by deductor
Dec/2018 = 100

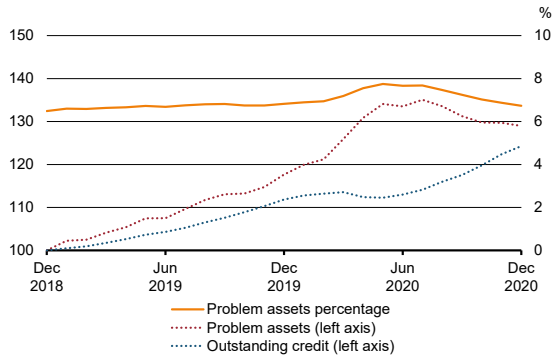


Statistical annex

32 Provisional Measure 1,006, of October 1, 2020, which increased until December 31, 2020 the maximum percentage of deduction to 40%, of which 5% is destined exclusively for amortization of expenses made through a credit card or for withdrawal through the credit card. Law 14,131/2021 extended the increase in the maximum deduction percentage until December 31, 2021.

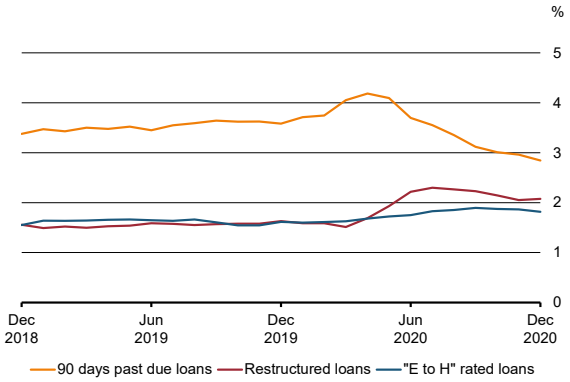
There is relevant uncertainty about the risk of the households' portfolio due to the unfolding of the pandemic. In the second half of 2020, the decrease in the percentage of problem assets was due both to the decrease in the problem assets portfolio – related especially to the drop in non-performing operations, due to the high volume of loans modified during the pandemic – and to the resumption of growth in the total portfolio (Charts 1.2.2.21 and 1.2.2.22). Ultimately, the evolution of risk will be tied to the development of the economic environment in 2021 as well as to the performance of the modified loans.

Chart 1.2.2.21 – Problem assets
Households



Statistical annex

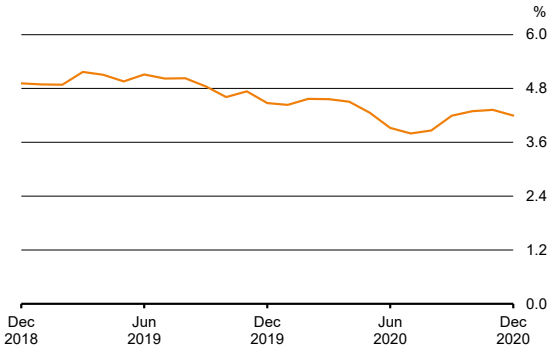
Chart 1.2.2.22 – Problem assets by credit event
Households



Statistical annex

There was worsening in operations not yet classified as problem assets. The recent growth in pre-problem assets (Chart 1.2.2.23), after the drop that occurred at the end of the first half of the year – most likely due to modified loans –, should lead to some increase in problem assets in 2021. However, in relation to modified loans, a significant part of them have already left the grace period and present a payment level higher than initially expected.[33] The extent to which this risk materializes will ultimately depend on the evolution of the economic scenario, which is still uncertain.

Chart 1.2.2.23 – Pre-problem assets
Households



Statistical annex

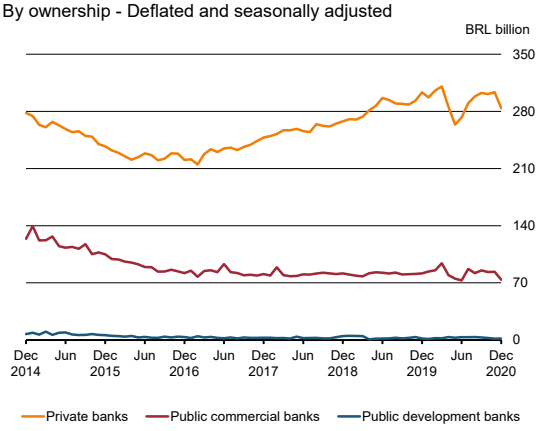
Domestic banking credit – By ownership

In the second half of 2020, monthly credit lending returned to the pre-crisis level and the domestic credit portfolio increased its pace of growth in both public and private banks. The beginning of the Covid-19 pandemic was followed by a sharp drop in credit lending, mainly observed in private banks (Chart 1.2.2.24), presenting a 10% decrease in the second quarter of 2020 when compared to the previous quarter. In the last quarter of 2020, credit-lending returned to the level observed in the same period in 2019, considering deflated and seasonally adjusted values. The development of the emergency credit programs at the beginning of the second semester boosted the growth of the

33 On the concept of pre-problem assets, refer to subsection "Companies". For the discussion on the overall volume of modified loans, see subsection "Risks and provisioning".

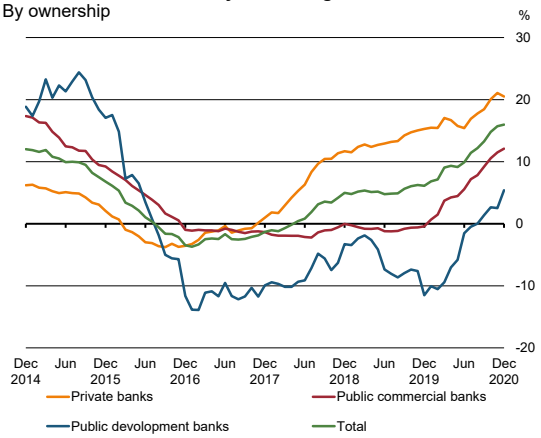
credit portfolio of private and public commercial banks (Chart 1.2.2.25). Public development banks credit portfolio started to grow after contraction during the previous four years.

Chart 1.2.2.24 – Credit lending
By ownership - Deflated and seasonally adjusted



Statistical annex

Chart 1.2.2.25 – Year over year credit growth
By ownership



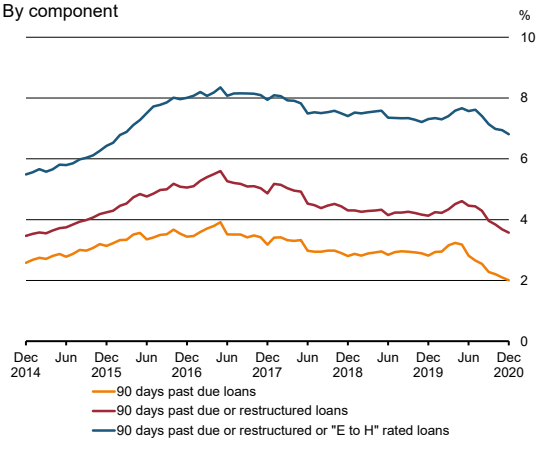
Statistical annex

Risks and provisioning

The risk already materialized in the domestic banking credit portfolio suffered a slight reduction in the second half of 2020, partly due to loan modifications. In the first five months of the crisis, the balance of problem assets in the credit portfolio increased by 10% (approximately R$25 billion). After this period, the problem asset portfolio slightly decreased, mainly due to the loan modifications carried out in the period. Together with the sharp increase in the credit portfolio, the problem asset ratio decreased in the second half of 2020 (Chart 1.2.2.26).

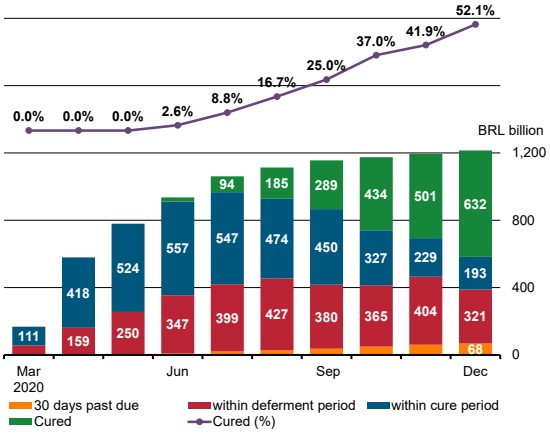
The expectation that loans modifications will generate significant losses for the SFN has been reduced. Since the beginning of the crisis, around one-third of the credit portfolio has been modified. Of this amount, 84% left the deferment period, and 52% was already cured in December 2020[34] and returned to the usual standard payment flow (Chart 1.2.2.27). The modified loan portfolio has shown a higher credit quality than initially expected and, therefore, the overall risk level of the credit portfolio has not increased. Problem assets ratio reached 6.8% in December 2020, a lower level than the maximum historical point of 8.3% observed in May 2017 (Chart 1.2.2.26).

Chart 1.2.2.26 – Problem assets
By component



Statistical annex

Chart 1.2.2.27 – Modified loans
By status



Statistical annex

SFN's provisions are enough to support expected credit losses. The provisions set up by the financial institutions increased by 13.9% (approximately R$ 30 billion) between February and December 2020 and reached the highest historical problem asset ratio. Considering estimates of expected losses for the credit portfolio made by the BCB

34 Loan modifications are considered cured after three months from the renegotiation date or the end of the deferment period, if any, if they have not been 30 days past due.

based on PD and LGD (loss given default) models,[35] the provisioning of the financial system proved adequate both for modified and not modified loans, with a total expected loss coverage index of 1.09 (Table 1.2.2.2).

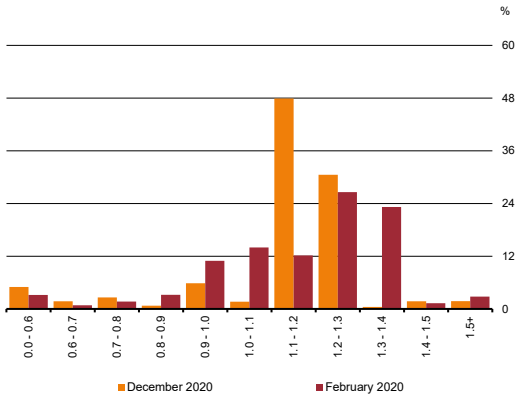
Table 1.2.2.2 – Expected loss and provisioning

Credit portfolio	Expected loss	Provision	Coverage
Modified loans	9.0%	9.4%	1.04
Not modified loans	4.0%	4.5%	1.13
Total	5.5%	6.0%	1.09

Statistical annex

The level of provisions supports expected credit losses in the SFN, and the proportion of the domestic credit portfolio that belongs to institutions with an expected credit loss coverage index greater than 1.0 (one) has increased since the beginning of the pandemic. More than 84% of the domestic credit portfolio belongs to institutions with coverage of expected credit loss due to provision greater than 1.0 (one) in December, while this proportion was 80% in February 2020. The concentration of the percentage of the credit portfolio in the coverage index ranges between 1.1 to 1.3 (Chart 1.2.2.28), observed in December 2020, stands out.

Chart 1.2.2.28 – Domestic Credit Portfolio
By expected credit loss coverage



Statistical annex

1.2.3 Profitability

The health crisis affected bank's profitability in 2020 but without posing significant risks to financial stability36. The pandemic interrupted the recovery in profitability that had been occurring since 2015-2016 (Chart 1.2.3.1). The system's net profit fell 26% compared to the previous year. The return on equity (ROE) was 11.5%,[37] the lowest level in our records. Loan loss provision (LLP) expenses increased, credit margin was under pressure and the pace of growth of services revenues reduced. Costs remained under control. Competition, innovations and the increased use of digital channels create opportunities and challenges in the SFN. Despite the shock of the pandemic, the system remained profitable, which contributed to sustain the capital levels and the flow of credit to the real economy.

The profitability of the system tends to improve in 2021, but uncertainty remains high due to the pandemic. The high level of LLP and the recovery of economic activity are the main pillars for the rebound in banks' profitability in

35 PD models estimate the likelihood that credit operations will become problem assets over the twelve-month horizon. The LGD models estimate the percentage of the value of the problem assets that materializes in a loss in 36 months horizon from the occurrence of the credit default. The expected credit loss is the product between the parameters of PD, LGD and the value of credit operations.

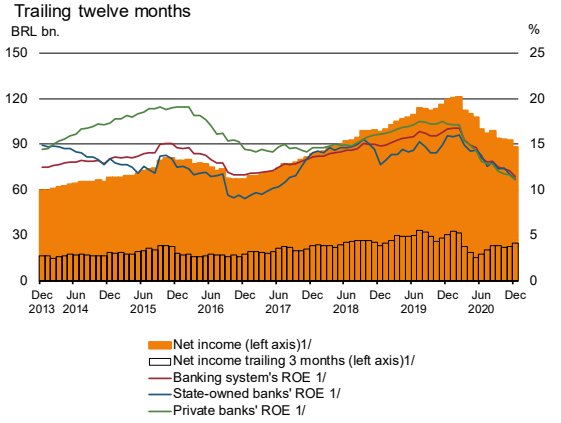
36 Profitability affects bank resilience. Banking systems with low profitability need more time to build their capital and liquidity ratios. This can restrict the availability of credit to the real economy and/or the ability of institutions to absorb shocks, such as losses in the credit and/or securities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

37 Refers to the twelve-moth trailing ROE.

2021. The increase in LLP in 2020 reduces the need for significant additional provisions, and the economic recovery contributes to credit growth and quality, as well as to increase the demand for banking services. The pandemic remains the main risk for the profitability rebound in 2021, as it may delay the economic recovery and increase the need for additional provisions for credit losses.

The increase in LLP was the main determinant for the fall in the systems' profitability. LLP expenses totalled BRL111.2 billion in 2020, an increase of 30% in comparison to 2019. The relationship between these expenses and the credit portfolio also increased significantly and approached the levels observed in the 2015-2016 crisis (Chart 1.2.3.2). With the increase in LLP, the Coverage Index (CI) of problem assets reached the highest level in history.[38]

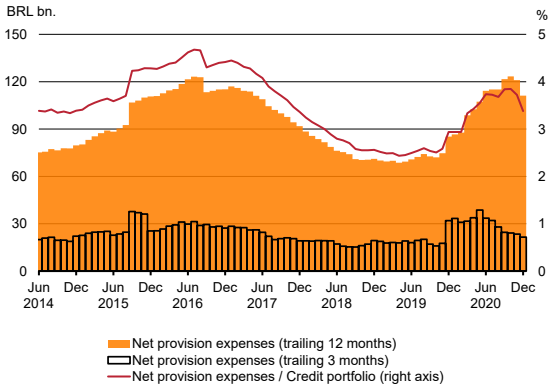
Chart 1.2.3.1 – Return on equity (ROE)[1/]
Trailing twelve months



1/ Adjusted by identified non-recurrent results.

Statistical annex

Chart 1.2.3.2 – Provision expenses



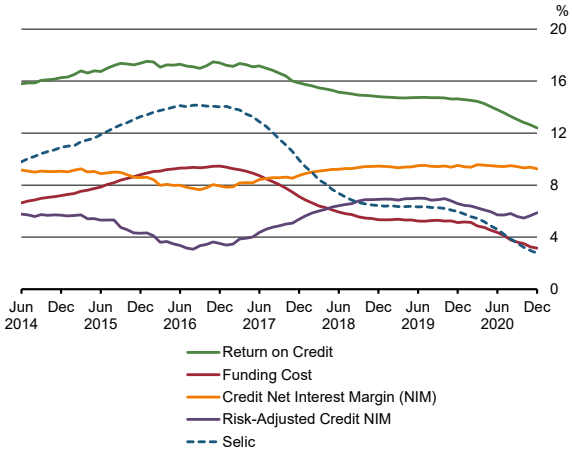
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Banks' profitability is expected to benefit from lower LLP expenses in 2021. After rising in the first half of the year, LLP expenses decreased in the second half of 2020. Despite the uncertainty about the length of the pandemic and its effects on credit quality, the BCB estimates that current provisions are enough to cover expected losses.[39] LLP expenses are expected to return to pre-pandemic levels, and this should be the main determinant of the improvement in banks' profitability in 2021.

Credit margin[40] declined slightly in 2020 and may be under pressure in the short term with further rises in the Selic rate. The return on credit decreased faster (-2.22 p.p.) than the cost of funding (-1.96 p.p.) in 2020, which pressured the credit margin in the year (Chart 1.2.3.3).[41] The faster drop in the credit return resulted from the combined effect of a strong portfolio growth and lower interest income. Despite the growth in the loan portfolio, it occurred in products with lower interest rates,[42] and lower returns. In addition to suffering the effect of lower interest rates throughout the year, interest income was impacted by the cap on the overdraft interest rate.[43] Funding costs decreased but rose relative to the Selic rate.[44,45] In the short term, eventual rises in the Selic rate may increase the cost of funding and put the credit margin under pressure.

38 See item 1.2.3 of this Report.
39 See section 1.2.3. of this Report for more information.
40 Refers to the net interest margin from credit operations, calculated by the difference between the return on credit (credit income in the last twelve months divided by the average credit portfolio in the period) and the cost of funding (funding expenses in the last twelve months divided by the average stock of funding in the period).
41 Due to the floating and short-term nature of funding, the cost of funding tends to respond more rapidly to changes in the Selic rate than the return on credit. Since the beginning of the downward cycle in the Selic rate, in October 2016, the funding cost has decreased faster than the return on credit.
42 The growth of credit to individuals was higher in the "real estate" and payroll-deductible" segments. In the corporates' portfolio, the growth was stronger in the "working capital" segment, which was influenced by loans originated under the pandemic emergency programs.
43 Resolution 4,765, of 27 November 2019, established the maximum interest rate of 8% per month on overdraft credit.
44 In this case refers to the 12-month trailing Selic rate.
45 See section 1.2.1 of this Report for more information.

Chart 1.2.3.3 – Credit margins



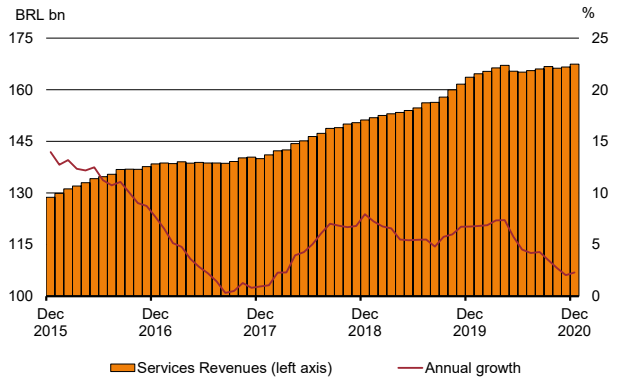
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Services revenues suffered the effects of the pandemic but have been responding positively to the rebound in economic activity. After falling in the first semester due to mobility restrictions, revenues rebounded in response to a recovering economy and a relaxation on those restrictions, growing 2.4% in the year (Chart 1.2.3.4). The growth was mainly due to an increase in revenues of the capital markets and the payment services businesses, which more than offset lower revenues from the administration of constitutional funds and bank account related fees.[46]

Competition and innovations in the SFN, such as Pix47 and Open Banking, should create challenges and opportunities for service revenues in the coming years. On the one hand, more incentive to competition can affect revenues in the short term. On the other hand, there are new opportunities for improving customer loyalty, providing new services, partnering with fintechs and payment institutions and for reducing costs. Pix, for example, is expected to have an impact on income from payment transfers and may affect other income streams as its use intensifies but tends to reduce FI's costs with currency management and other costlier forms of payments.

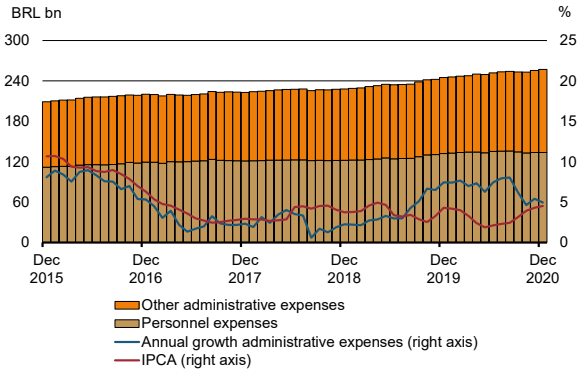
Administrative expenses remained under control in the period. In recent years, the growth in administrative expenses has followed the changes in the inflation rate (IPCA[48]), which reflects FI's cost control (Chart 1.2.3.5). In 2020, it was not different, a result of the cost reduction strategies adopted by FI. Expenses increased 5% in the period, but there were significant exchange rate effects on the expenses of branches and subsidiaries of FI abroad. Without these effects, the increase would have been of only 1.3%, below the IPCA rate of 4.5% in the period.

Chart 1.2.3.4 – Services Revenues
Trailing twelve months



Statistical annex

Chart 1.2.3.5 – Administrative expenses
Trailing twelve months



Statistical annex

46 Revenues from capital markets benefited from the rise in equity issuance and from the record-high volume traded on B3, while the revenues from payments services benefited from the increase in volume in card transactions. Revenues from the management of constitutional funds decreased in response to a reduction in the Federal Severance Pay Fund (FGTS) management fee. Bank account related fees were impacted by lower revenues from account services and from annual credit card fees charged to individuals.

47 See section 2.4 of Chapter 2 for additional information.

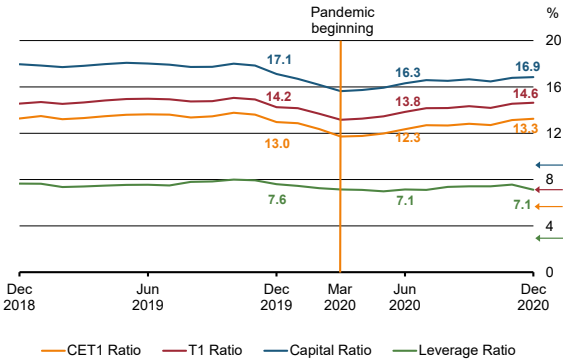
48 The Extended National Consumer Price Index (IPCA) is the BCB reference for the Brazilian inflation-targeting system.

The digital channels should contribute to improving the operational efficiency of the system in the medium term. The number of brick-and-mortar branches and employees in the banking system continued to decline in 2020. This trend is expected to continue in the coming years with the increasing use of digital channels by institutions and their customers. The Covid-19 pandemic has been a catalyst in this process[49]. The migration to digital channels should initially demand higher investments in technology to then reduce costs and increase the operational efficiency of FI in the future.

1.2.4 Solvency

Despite the Covid-19 pandemic adverse effects, the banking system remains solid, with capital ratios returning to pre-pandemic levels (Chart 1.2.4.1). This recovery was stimulated by CMN and BCB measures aiming at capital expansion and metrics adjustment to the incurred risks. Most institutions fulfill all capital requirements using solely Common Equity Tier 1 (CET1), the core capital (Chart 1.2.4.2). Solvency does not represent risk to financial stability, the system being able to sustain regular market functioning.

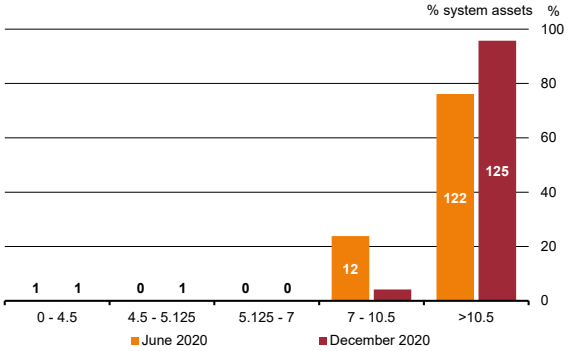
Chart 1.2.4.1 – Capital ratios and regulatory requirements[1]



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

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Chart 1.2.4.2 – CET1 Ratio
Frequency distribution[1]



1/ Inside the bars are the number of financial institutions in the correspondent CET1 ratio range

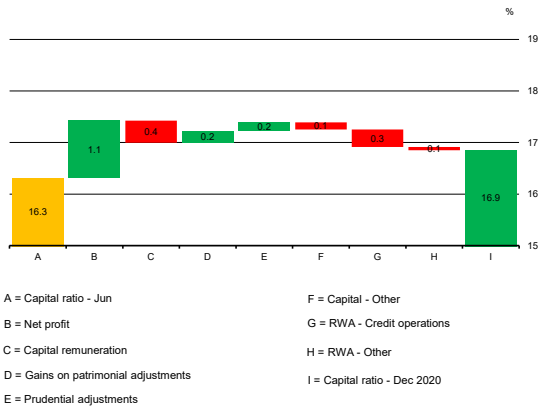
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The system capital quantity improved as well as quality. The earning retention, encouraged by restrictions on capital remuneration, was the main driver of the capital ratios recovery in the semester (Chart 1.2.4.3). The profit was higher than 2020 first half, but dividend distribution[50] was reduced due to regulatory restrictions (Chart 1.2.4.4). The CET1 was also increased by prudential adjustments reduction, gains on securities available for sale and actuarial items. Adding to this scenario the Additional Tier 1 and Tier 2 capital retractions of 5.6% and 8.2%, respectively, the CET1 share in total capital increased from 75.7% to 78.6%.

49 In addition to the benefit in terms of operational efficiency to the banks, digital channels were essential to enable individuals' access to payment aid during the pandemic, with positive effects to financial inclusion in the country. For additional information, see the Financial Stability Report of October 2020.

50 Most of the capital remuneration of 2020 first half refers to 2019 and was distributed by private banks before the restrictions imposed by CMN Resolutions 4,797, of April 6th, 2020 and 4,820, of May 29th, 2020.

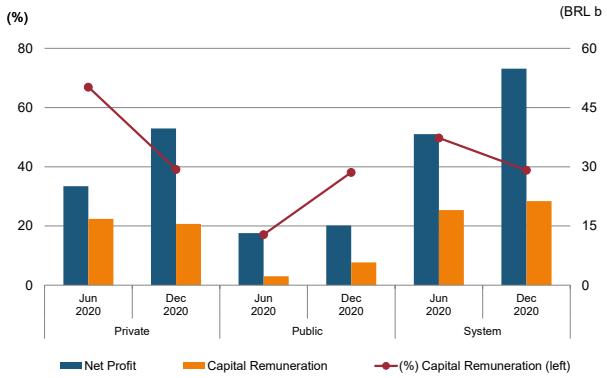
Chart 1.2.4.3 – Capital Ratio Variation



A = Capital ratio - Jun
B = Net profit
C = Capital remuneration
D = Gains on patrimonial adjustments
E = Prudential adjustments
F = Capital - Other
G = RWA - Credit operations
H = RWA - Other
I = Capital ratio - Dec 2020

Statistical annex

Chart 1.2.4.4 – Capital Remuneration[1]



Statistical annex

The credit growth was the key factor for the required capital increase. The Risk-Weighted Assets (RWA) rise was concentrated in the credit share (Table 1.2.4.1), mainly due to more credit concessions. Capital requirement was also affected by regulatory changes in the period.[51]

Table 1.2.4.1 – RWA Composition

R$ billions	System			Var. (%) Dec/Jun	
	Jun/20	Dec/20	Var. (%)	Public	Private
Total RWA	**4,957**	**5,076**	**2.4%**	**3.7%**	**1.9%**
Credit RWA	**4,221**	**4,340**	**2.8%**	**5.0%**	**1.9%**
Credit operations	2,009	2,110	5.0%	5.4%	4.8%
Mortgages	302	330	9.3%	6.1%	16.7%
Leasing	18	18	-1.1%	-9.4%	-1.0%
Interbank investments	149	150	0.7%	8.2%	-2.1%
Securities	261	265	1.6%	-9.8%	4.3%
Derivatives	227	182	-19.6%	-40.3%	-17.6%
Fixed Assets	191	210	10.2%	17.4%	7.7%
Non-cancellable credit commitments	136	149	8.9%	9.1%	8.9%
Guarantees provided	255	259	1.7%	4.1%	1.0%
Tax assets	452	420	-7.1%	10.7%	-12.5%
Other	523	577	10.4%	4.4%	12.5%
Market RWA	**232**	**238**	**2.6%**	**36.4%**	**-2.5%**
Operational RWA	**505**	**498**	**-1.3%**	**-9.8%**	**4.0%**

Statistical annex

51 Circular 3,998 of April 13th, reduced from 100% to 85% the risk weight (RWF) applied to credit exposures to small or medium enterprises not qualified as retail, granted or restructured between March 6th and December 31th, 2020.
Circular 4,026, of June 10th, 2020, established a 12% RWF to exposures under the Pronampe, instituted by Law 13,999, of May 18th.
Circular 4,030, of 23th June 2020, reduced from 50% to 35% the RWF applied to guaranteed time-deposits (DPGE) when the deposit holder is an institution associated to the Deposit Insurance Fund (FGC).
Circular 4,034, of June 29th, 2020, reduced the RWF for exposures to credit operations granted under the Emergency Credit Access Program (PEAC), instituted by Provisional Measure 975, of June 1st, 2020, converted to Law 14,042, of August 19th.
Provisional Measure 992, of July 16th, 2020, instituted the Working Capital Program for enterprise preservation (CGPE) and treated deferred tax assets.
BCB Resolution 12, of August 25th, 2020, established the 100% RWF for the mentioned assets.
BCB Resolution 17, of September 17th, 2020, established that the emergencial programs to support jobs (Pese) and to grant credit (Peac-Maquininhas) should not constitute exposure if they count on Treasury resources or guarantee, according the Laws 14,043 and 14,042, of August 19th, 2020.

1.2.5 Stress tests

Capital stress tests

In all simulated scenarios for capital stress tests the banking system has shown adequate resilience. There are no relevant non-compliances both in the adverse macroeconomic scenarios as well as in a specific test considering the effects of the pandemic. The results obtained in the sensitivity analyses also show a good resistance to isolated simulated factors, in addition to stability of results compared to previously performed tests. The liquidity 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.

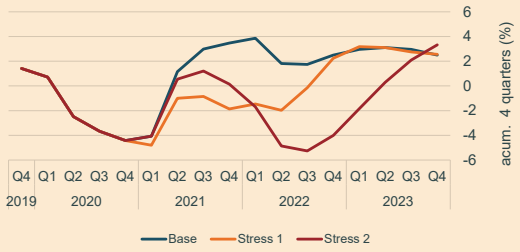
Stress test now incorporates scenarios with macroeconomic narratives

All scenarios used in the macroeconomic stress tests published until the report of October 2020 were based on purely statistical methodologies, with no intention of describing any prospective state of the economy. As of April 2021, the stress scenarios, called Stress 1 and Stress 2, described below, seek to describe, through the state of the macroeconomic variables used, an environment or context of stress (Charts 1.2.5.1 to 1.2.5.5).

Scenario "Stress 1" assumes that the economy would halt its recovery trajectory, with a further GDP drop due to insufficient aggregate demand. This scenario is built on an assumed contraction of the GDP in 2021, using as reference the unexpected decline in GDP observed in 2015, in relation to the projections made at the end of 2014, found on the Market Expectations System of the Central Bank of Brazil (Focus Report). It is also assumed that the world's recovery would be interrupted, resulting in a drop of the world's GDP, in a strengthening of the dollar, and drop in commodity prices, thus affecting domestic activity. As to Brazil's economy, both household consumption and gross fixed capital formation would decline again, due to external factors such as an extension of the effects of the pandemic. 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 small currency depreciation. In line with a 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.

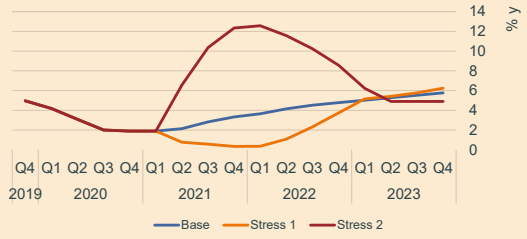
Scenario "Stress 2" is characterized by a significant increase in uncertainty in the economy throughout 2021 due to fiscal deterioration, leading to increased risk premiums, sharp exchange rate depreciation, an increase in the economy's neutral interest rate and a contraction in economic activity. To 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. As for the global economy, like "Scenario 1," it is also assumed that the recovery would be interrupted, with a drop in the world's GDP, a strengthening of the dollar and falling commodity prices. Despite the fall in domestic GDP and the increase in unemployment rate, here the inflationary effect of currency depreciation would prevail. The significant increase in inflation would lead the BCB to increase the interest rates. In this scenario, it is assumed that the BCB would move interest rates to ensure that the inflation remains around the target throughout the fiscal year horizon, but this does not necessarily mean that the BCB would act in this way.

Chart 1.2.5.1 – IBCBR



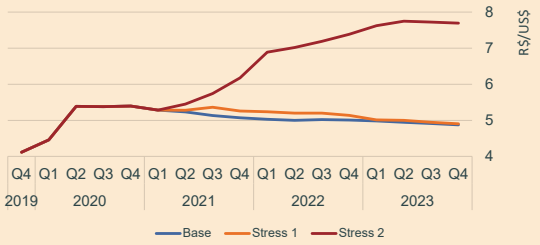
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Chart 1.2.5.2 – Selic



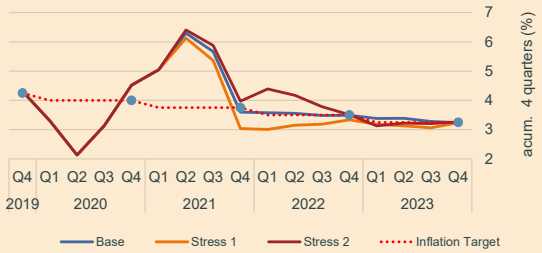
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Chart 1.2.5.3 – Exchange Rate



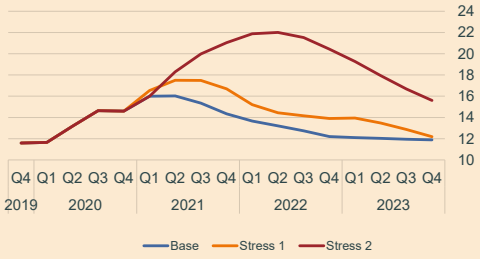
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Chart 1.2.5.4 – Inflation



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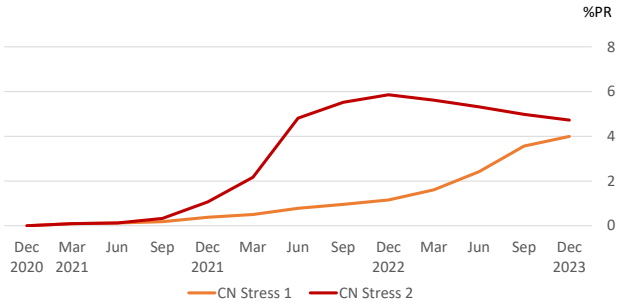
Chart 1.2.5.5 – Unemployment



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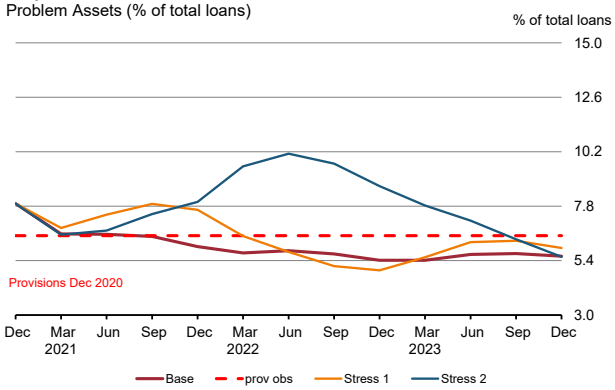
The estimated need for capitalization of the system is low in both simulated scenarios confirming the adequate capacity of the system for loss absorption. The largest capital need would be of 5.9% of the current PR of the system in the 8th quarter of the simulation of "Stress 2" scenario. This scenario was the most severe, and it will thus be used as a reference in this report. By the end of the simulation, capital needs reduce to 4.7% of the PR (Chart 1.2.5.6). APs, on the other hand, would reach 10.1% of total loans (Chart 1.2.5.7). Institutions that together account for 96% 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 Need
Stress 1 and Stress 2 Scenarios



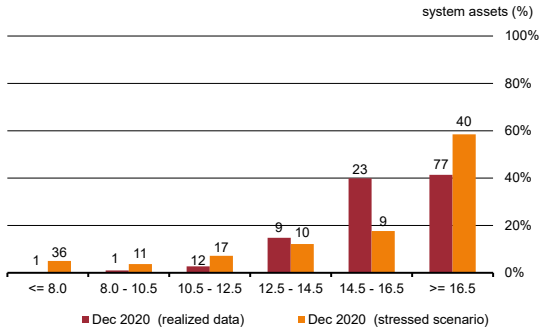
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Chart 1.2.5.7 – Macroeconomic Stress
Problem Assets (% of total loans)



Statistical annex

Chart 1.2.5.8 – Macroeconomic Stress Test
Frequency distribution of system assets by Capital ratio band – Stresse 2 Scenario[1/]



1/ The value above each bar represents the number of institutions per band.

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Sensitivity analysis

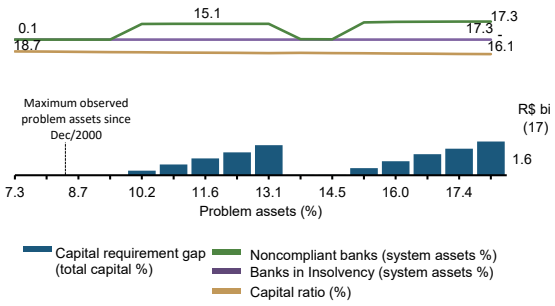
The system has low sensitivity to shocks on the exchange rate. There are no non-compliances even for an exchange rate equivalent to twice the rate observed in December 2020. The low observed net exposure inhibits adverse effects resulting from drastic fluctuations in the exchange rate.

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 5.1% of the PR, and the affected banks account for 32% of the system's assets. The low exposure to assets that are sensitive to fixed-rates reduces the sensitivity to shocks in the interest rate.

There is no need for capital even with the APs reaching their highest historical mark. It would be necessary for the APs to reach 10.2% of total loans to create a need for capital, a percentage higher than the historical maximum of 8.6% observed in May 2017 (Chart 1.2.5.9). In an extreme situation, if the proportion of problematic assets reaches 18.1% of the credit portfolio (1.5 times the current value), there would be a need for capital equivalent to 1.6% of the system's PR. This would represent 17.3% of the system's assets.

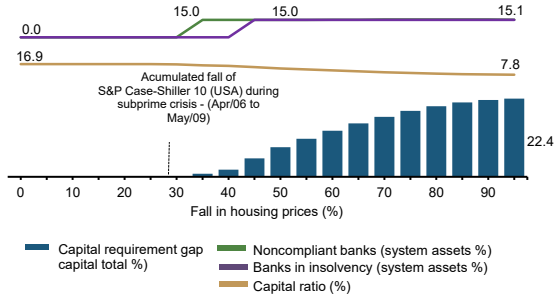
Simulations of reductions in residential property prices shows a very small possibility of non-compliance. There would only be a need for capital in the event of a nominal drop of at least 35% in the collateral price real estate credit operations, a percentage like the accumulated fall of the S&P Case-Shiller during the U.S. subprime crisis. Only a reduction of 45% or more in nominal prices would lead to insolvency, characterized by negative principal capital. In December 2020, the stock of the residential real estate loan portfolio had an average LTV of 57%, considering collateral prices update 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).

Chart 1.2.5.9 – Sensitivity analysis
Credit risk



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Chart 1.2.5.10 – Sensitivity analysis
Housing prices risk



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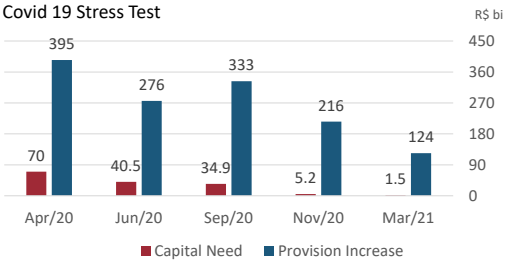
Simulation of direct interbank contagion

The simulation suggests 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 PR. 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 relevant in some cases, which explains the identified need for capital.

Stress test – Covid-19

The results of the stress test to measure the effects of the pandemic on the financial system show gradual reduction of impact. The first test was performed on the base date of December/19 and has been repeated quarterly ever since. Both the provision and the resulting capital requirements have declined, showing a downward trend. The shock of an increase in provisions and loss recognitions would cause the Basel Index to be reduced by 1.6%, compared to 4.1% in the previous report, and R$1.5 billion of regulatory capital would be needed (which amounts to 0.1% of the total PR of the financial system) for all institutions to comply with the regulatory capital minimums. In the previous report, the need for capital was estimated at R$34.9 billion, which was equivalent at the time to 3.5% of the system's PR. These results indicate a cooling of the effects of the pandemic on the system, motivated both by the recent (albeit modest) recovery in economic activity, as well as by the improvement in the system's quality of capital and overall financial indicators (Chart 1.2.5.11).

Chart 1.2.5.11 – Capital Need Evolution
Covid 19 Stress Test



Statistical annex

Liquidity stress tests

The Liquidity Stress Test indicates that banking institutions have improved their resilience to cover different shocks that can affect short-term liquidity. The main drivers of the short-term liquidity stress tests of banking institutions are the shocks associated with the early withdraw of depositors and the market parameters' stress on liquidity (market stress). The improvement stems from the recent increase in the stock of liquid assets in local currency and was accompanied by a reduction in the impact of various stress tests in the recent period, both for the effects of losses resulting from fluctuations in the financial assets' prices, as well as deposits' withdrawals and other cash outflows.

The scenario of early withdraw of depositors52 showed less commitment of the institutions' liquid assets compared to observed in the beginning of the pandemic. This scenario contemplates shocks of wholesale depositors and other clients for a thirty days' horizon. The shock applied for the other clients deposits' withdrawals scenario considers the history of the deposit balance plus a complementary loss, according to the depositor's profile and the type of financial instrument.[53] Despite the increase in the volume of deposits subject to a stress scenario of early withdraw of depositors from the end of the 1st quarter of 2020, there was a reduction in the volatility of deposits as of the second semester of 2020, accompanied by an increase in the stock of financial institutions' liquid assets. The result of this behavior for banking institutions was to reduce the potential impact of this stress test in relation to the stock of liquid assets in February/2021 (Chart 1.2.5.12).

The result of the shocks in the market parameters shows that banking institutions had continued presenting resilience to cope eventual cash outflows and potential devaluations in liquid assets in the short-term horizon. This simulation is based on projections of shocks in market parameters,[54] amount necessary to cover losses arising from fluctuations in the prices of liquid assets positions, combined with other cash outflows of the institution's resources. This simulation is based on projections of shocks in market parameters, amount necessary to cover losses arising from fluctuations in the prices of liquid assets positions, combined with other cash outflows of the institution's resources.[55] The reduction of volatilities in the most recent period, combined with a reduction in foreign exchange exposure throughout 2020[56] contributed to the decrease in the need for cash to cover resource limitations or devaluations of liquid assets (Chart 1.2.5.13).

52 The early withdraw of depositor's 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 (CIs) to be due and CIs with early redemption clause. See the annex for details of the IL methodology.

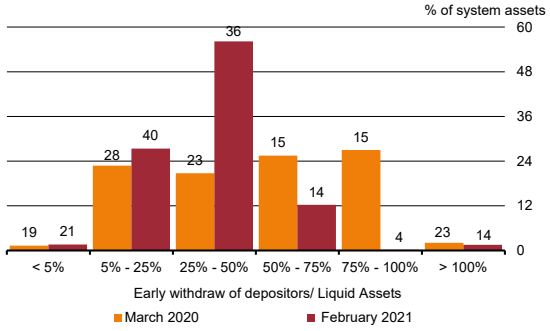
53 The other client deposits' withdrawals scenario considers the historical behavior of the daily balance of deposits with a confidence interval of 99% for the 100-business day series. In addition, there is a third category of investors considered in the stress scenario, which are those with brokered deposits (CI) with specific shocks.

54 Stress tests consider the worst impact of high/low shocks scenario for the different market risk factors, independently, for each institution; that is, we may have two independent scenarios, one shock estimating an increase for a certain risk factor for institution A and other a decrease for the same risk factor for an institution B.

55 Resource losses/cash outflows include: (i) additional margin calls deposited in clearing houses; (ii) disbursements in positions of derivative markets; (iii) loss of value of liquid assets: unencumbered, Repo agreements falling due - financial position, and/or given as a guarantee in clearing houses and the BCB.

56 Reduction in foreign exchange exposure due to the decrease in the overhedge needs (hedge structure used to neutralize the effects exchange variation on investment abroad) with the enactment of Law 14,031, of July 28, 2020. For more details, see the selected issue section "Investment Abroad and Overhedge" in the FSR of October 2020.

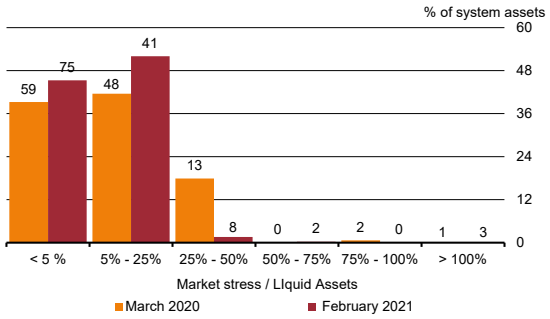
Chart 1.2.5.12 – Frequency distribution for Early withdrawal of depositors / Liquid assets/



1/ The values on the bars refer to the number of financial institutions with the estimated early withdrawal of depositors in relation to the liquid assets belonging to the corresponding interval.

Statistical annex

Chart 1.2.5.13 – Frequency distribution for Market stress/ Llquid assets1/



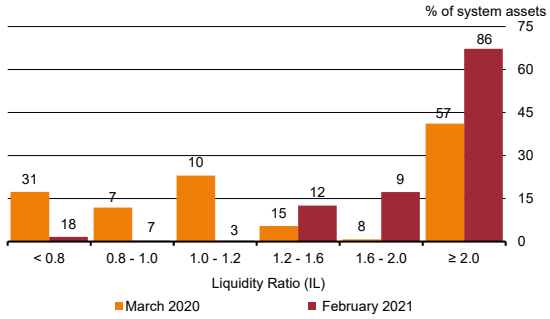
1/ The values on the bars refer to the number of financial institutions with the estimate of market stress in relation to the liquid assets belonging to the corresponding range.

Statistical annex

The joint analysis of the main drivers of the liquidity stress test reinforces the perception of the reduction of short-term liquidity risk. The components of early withdrawal of depositors and market stress reduced the potential impact in relation to the liquid assets stock in February/2021. As a result, the banking system entered the 1st quarter of 2021 with greater liquidity surplus compared to the scenario projected by the liquidity stress test, when compared to the beginning of the pandemic crisis, in the 1st quarter of 2020. A joint analysis, using the Liquidity Ratio (IL) Methodology, which compares the institution's liquid assets stock in relation to the sum of the main drivers and other shocks with less impact.[57] The results indicate an improvement in this ratio, considering both the number of institutions that have liquid assets for this severe stress test (IL> = 1), and the representativeness of the set of institutions, which would contemplate more than 97% of the total assets of the banking system (Chart 1.2.5.14).

The impact of potential liquidity support to investment funds on fund managers linked to the banking system remains low and is not a matter of concern. The step-in risk is the ratio between the potential liquidity support[58] to investment funds provided by their bank-linked managers – estimated in a scenario of strong withdrawals in investment funds[59] – and the excess liquidity of the banking system – 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 and remained below 6% throughout 2020 (Chart 1.2.5.15). The excess liquidity of the banking system remains high (Chart 1.2.5.14) and the step-in risk is not a matter of concern.

Chart 1.2.5.14 – Frequency distribution for the Liquidity Ratio (IL)1/



1/ The values on the bars common to the number of financial institutions with the Liquidity Ratio (IL) belonging to the corresponding range.

Statistical annex

Chart 1.2.5.15 – Investment funds' step-in risk
Potential support as a share of banks' excess liquidity



Sources: BCB and CVM.

Statistical annex

57 See the Liquidity Ratio methodology (IL) in the annex for a comprehensive list of the components of the stress scenario.

58 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/en/publications/financialstabilityreport/201710. The strong presence of entities belonging to the banking system in the investment fund management market justifies the monitoring of this potential financial support.

59 In a scenario of strong withdrawal requests, a fund manager, motivated by reputational issues, might consider buying a share of their funds' illiquid assets, providing them with the necessary liquidity to honor the requested redemptions. This financial support reduces the manager's liquidity position. Only financial institutions whose managed funds might demand liquidity support are included in the step-in calculation. Investment funds 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 period no longer than thirty days and whose financial statements are not consolidated into prudential conglomerates.

1.3 Financial Stability Survey (FSS)[60]

Confidence in the SFN stability remains high, reversing the slight downward trend of the latest surveys. The increase in delinquency and the reduction of economic activity is the primary concern of the financial institutions. According to the respondents, fiscal risks also remain relevant. Most financial institutions perceive the economy in a recovery phase, with high access to funding and liquidity. The respondents perceive households and companies as highly leveraged. Their confidence in financial stability during the pandemic has remained well above the 2015-16 recession levels. In line with this assessment, most respondents expect and suggest that the value of Countercyclical Capital Buffer for Brazil ($ACCP_{Brasil}$) should remain at 0%.

Risks to financial stability

"Delinquency and economic activity"[61] remains the main risk to financial stability. This is the most relevant risk for 45% of the financial institutions (Tables 1.3.1 and 1.3.2). This perception is associated with the economic crisis resulting from the pandemic and the risks of a slower recovery in economic activity. This risk has been high since the beginning of the pandemic. In the opinion of the financial institutions, the probability of occurrence is medium-high, and the impact would be high.

Table 1.3.1 – FSS – Average frequency of the most cited risks

Risk	Average frequency (citations/financial institution)			Probability	Impact
	Aug 2020	Nov 2020	Feb 2021	Feb 2021	
Delinquency and economic activity	1.02	0.98	1.02	Mid-High	High
Fiscal risks	0.75	0.78	0.85	Mid-High	High
Global scenario	0.67	0.80	0.75	Mid-High	High

Statistical annex

Table 1.3.2 – FSS – Citation frequency of the most important risk

Risk	Frequency (%)			Probability	Impact
	Aug 2020	Nov 2020	Feb 2021	Feb 2021	
Delinquency and economic activity	60	42	45	Mid-High	High
Fiscal risks	22	42	33	Mid-High	High
Global scenario	15	13	16	Mid-High	High

Statistical annex

Note: The respondents answer the following question: "In the next three years, which risks to the 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 combination of 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.

Fiscal risks are of concern to the financial institutions. These risks are associated with the uncertainty about how effectively public spending would minimize the pandemic effects and the progress of reforms. According to the respondents, a delay in vaccination and the emergence of new strains of the coronavirus may prolong the health crisis. They believe that economic activity could slow down and require additional public spending to protect the vulnerable population and encourage the recovery of the economy. Increased spending and the difficulties in implementing the reform agenda could raise government debt and sovereign risk.[62]

60 The BCB conducts quarterly survey to identify and monitor risks to financial stability according to the perception of regulated entities. The sample is made up of 55 financial institutions, which totaled 92.5% of the banking system's assets in December 2020. Since the last edition of the FSR, two FSS have been carried out, from October 26 to November 6, 2020, and from February 3 to 8, 2021, both with 100% response rates.

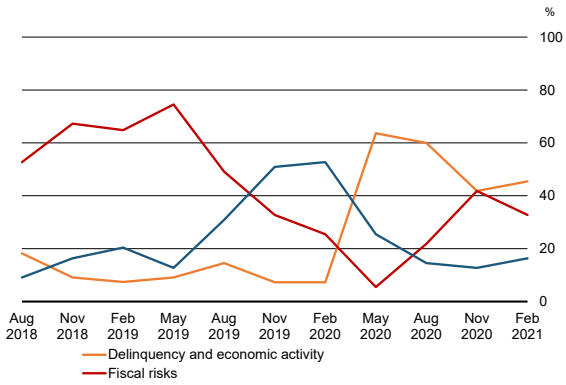
61 The "Delinquency and economic activity" class includes risk factors for financial stability arising from increased credit risk (delinquency) and a low level of economic activity or recession, potentially impacting the financial system.

62 According to the assessment made by an institution specializing in credit analysis, the sovereign credit risk rating is assigned to a debt-issuing country based on its ability and willingness to timely and fully meet its debt service obligations.

Risks in the global scenario are mainly related to the evolution of the pandemic and the pace of vaccination. The financial institutions believe that global activity recovery may be slower and uneven due to the progress of vaccination and the effects of new coronavirus strains. Other sources of concern are a swifter unwinding of the monetary stimulus in the United States and more restrictive trade policies that could significantly affect asset prices, risk premiums, and the foreign exchange rate in the domestic economy.

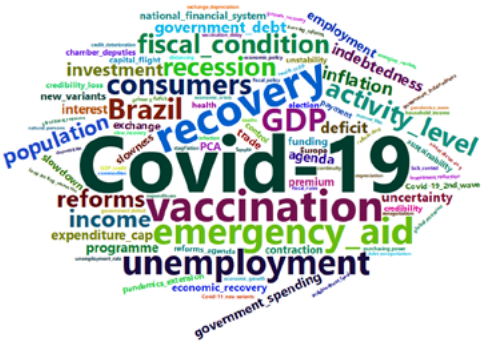
The pandemic caused a significant rebalancing of the most important risks. Delinquency risk has become the most relevant. Fiscal risks that were falling now gained momentum due to concerns about increased emergency spending and reduced tax revenues (Chart 1.3.1). A "word cloud" highlights expressions associated with the pandemic and its consequences for the economy, such as "Covid-19", "vaccination", "recovery", "emergency aid", and "activity level" (Chart 1.3.2). Terms related to concerns with the progress of vaccination and the behavior of fiscal spending gained relevance in the last survey (Chart 1.3.3).

Chart 1.3.1 – FSS – Frequency of the most important risks



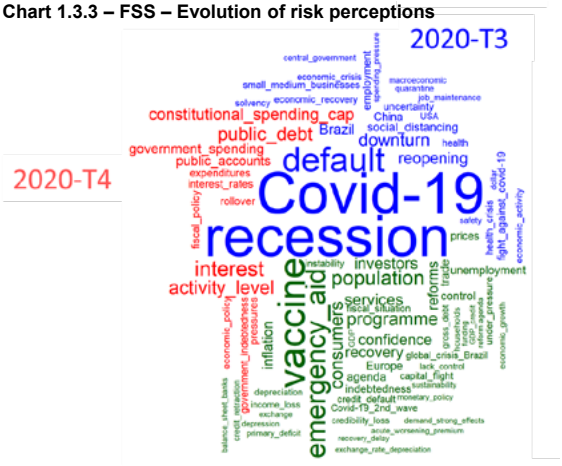
Statistical annex

Chart 1.3.2 – FSS – Word Cloud of the most important source of risk



Statistical annex

Chart 1.3.3 – FSS – Evolution of risk perceptions



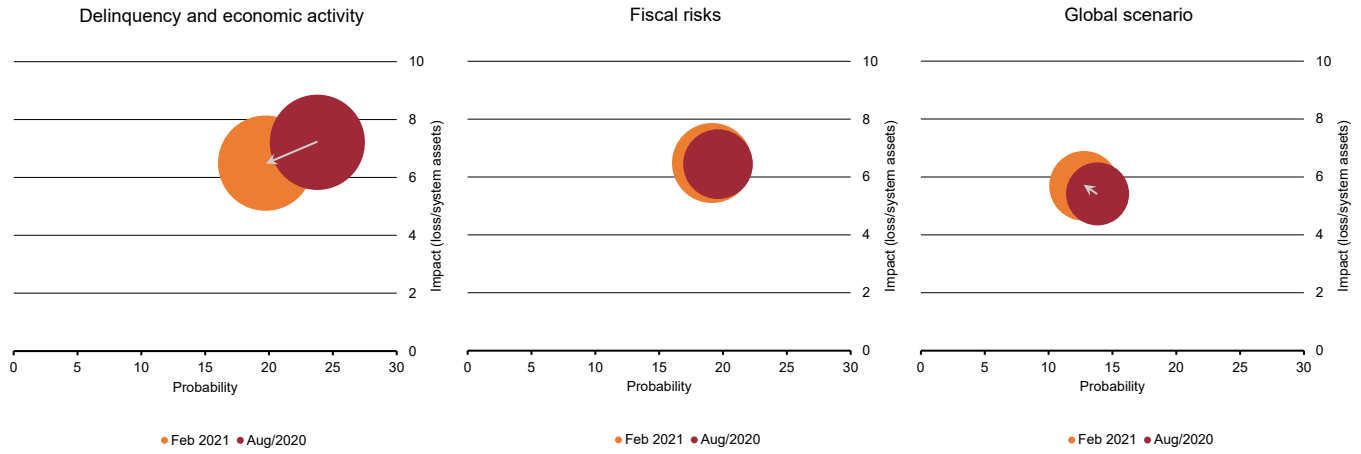
Statistical annex

Note: Left cloud is compiled from the textual analysis of descriptions about the most important risk. The size of the word is proportional to its frequency.

Note: Right cloud is compiled from the textual analysis of descriptions about the most important risk. The color of the word indicates the FSS in which the word frequency was predominant. The word size is proportional to the difference between the word frequency in the corresponding FSS and the average frequency of the entire sample (the three FSS).

The probability of materialization of relevant risks has decreased. The probability of materialization of the three most important[63] risks has decreased when compared with August 2020 and February 2021 (Chart 1.3.4). According to the financial institutions, fiscal, delinquency, and activity risks, coupled with risks originating from the global scenario are the most difficult to mitigate with internal measures.[64]

Chart 1.3.4 – FSS – Cited risks: probability, impact and frequency



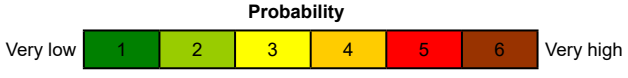
Statistical annex

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

The main risk transmission channels have enlarged. Credit rating downgrade has joined "risk aversion and uncertainty" and "capital flight and currency depreciation" as the main transmission channels in case of risk materialization. Liquidity freezes, including the interbank market and foreign credit lines, remain the least likely shock transmission mechanism in the current crisis. The financial institutions consider that the BCB's measures to combat the effects of Covid-19 and the monitoring effort have been effective in avoiding liquidity gridlocks (Table 1.3.3).

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

Transmission channel	Aug 2020 (median)	Nov 2020 (median)	Feb 2021 (median)	Distribution (last survey)
Contagion between markets and domestic institutions	4	4	4	1 2 3 4 5 6
Liquidity squeeze, 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	5	5	5	1 2 3 4 5 6
Decline in depositors confidence, including flight-to-safety	4	4	4	1 2 3 4 5 6
Capital flight or strong currency depreciation	5	5	5	1 2 3 4 5 6
Widespread credit rating downgrade, including sovereign ratings	4	5	5	1 2 3 4 5 6



Statistical annex

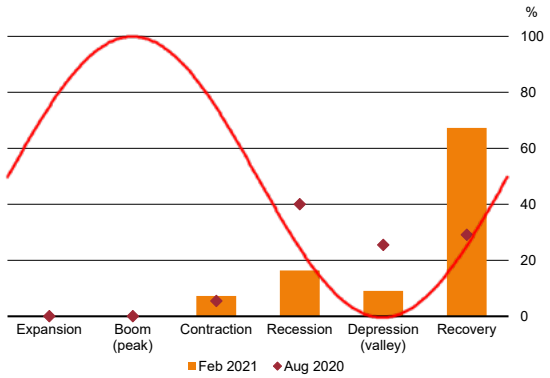
63 Question: "For each of the three mentioned risks, indicate the probability and impact, considering the following classes: i) probability: low (<1%); medium-low (1% -10%); medium-high (10 % -30%); high (> 30%); ii) impact (total SFN assets): very low (<0.1%); low (0.1% -1%); medium (1% -5%); high (5% -10%); very high (> 10%)".

64 Question: "Which of the risks listed above does your institution consider to be more difficult to mitigate with the adoption of internal risk management strategies by financial institutions, without the assistance of measures taken by the BCB and the federal government?" The response may involve more than one risk so that the average frequency of mention can reach values from 0 to 3.

Economic and financial cycles

Perception of the economic cycle becomes more positive. Compared with August 2020, many financial institutions believe that the economy is in a recovery phase (Chart 1.3.5). The percentage of respondents that consider the economy in recession or depression dropped from 65% to 25%.

Chart 1.3.5 – FSS – Economic cycle



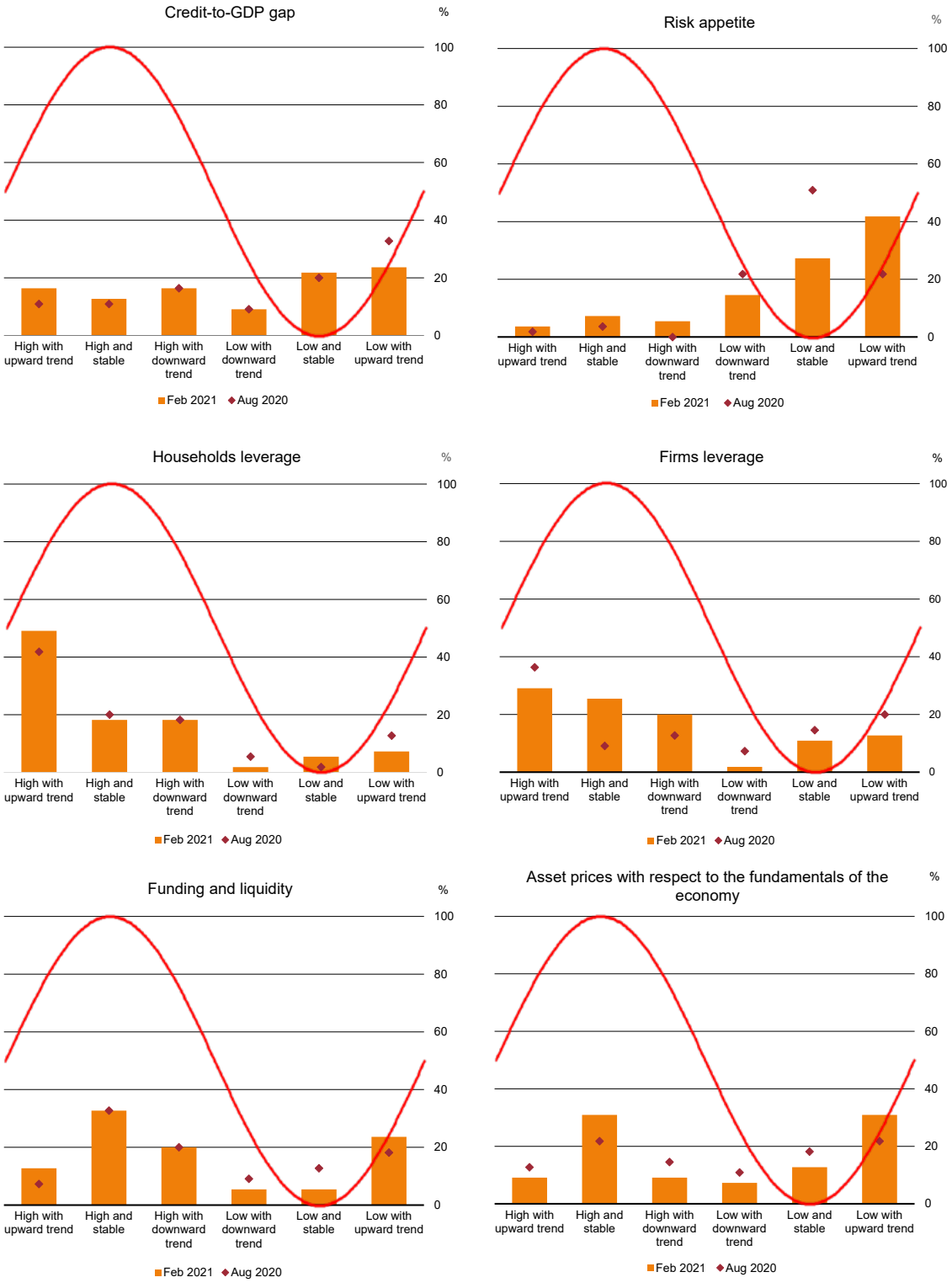
Statistical annex

Assessment of the credit/GDP gap is heterogeneous. The number of financial institutions that evaluates the credit/GDP gap as high increased, whereas the perception that the credit/GDP gap is on an upward trend fell from 44% to 40% between August 2020 and February 2021 (Chart 1.3.6).

Financial institutions' willingness to take risks is still low. The financial institutions continue to perceive households and companies as highly leveraged. The risk appetite is still low for most financial institutions, despite the decline in the number of respondents from 95% in August 2020 to 84% in February 2021. Conversely, a larger number of respondents evaluates that the willingness to take risks is on an upward trend. A higher share of financial institutions perceives that the leverage of households and companies is moving upwards. The perception that household indebtedness is on an upward trend prevails, although remaining stable over August 2020. The perception that the corporate leverage is on an upward trend declined (Chart 1.3.6).

Financial institutions continue to perceive high access to funding and liquidity. The financial institutions disagree on asset price levels. From August 2020 to February 2021, a more significant number of financial institutions considers that the liquidity level is both high and follows an upward trend. The respondents diverge about the evaluation of asset prices in relation to fundamentals: for 49% of them, prices are high, whereas, for 51%, prices are low (Chart 1.3.6).

Chart 1.3.6 – FSS – Financial cycles



Statistical annex

Resilience and confidence in the financial system

Despite the pandemic, confidence in the SFN stability is among the highest in the time series. Most of the financial institutions have full or high confidence in the SFN resilience (Table 1.3.4). Confidence in the SFN stability during the pandemic has been higher than in the 2015-2016 recession (Chart 1.3.7). The "full confidence" class increased,

whereas the number of respondents with “high confidence” prevail, accounting for 64% in February 2021. There have been no negative assessments (“no confidence” and “low confidence” classes) since the 2016Q3 survey.

Table 1.3.4 – FSS – Financial system capacity of reacting to high-impact events

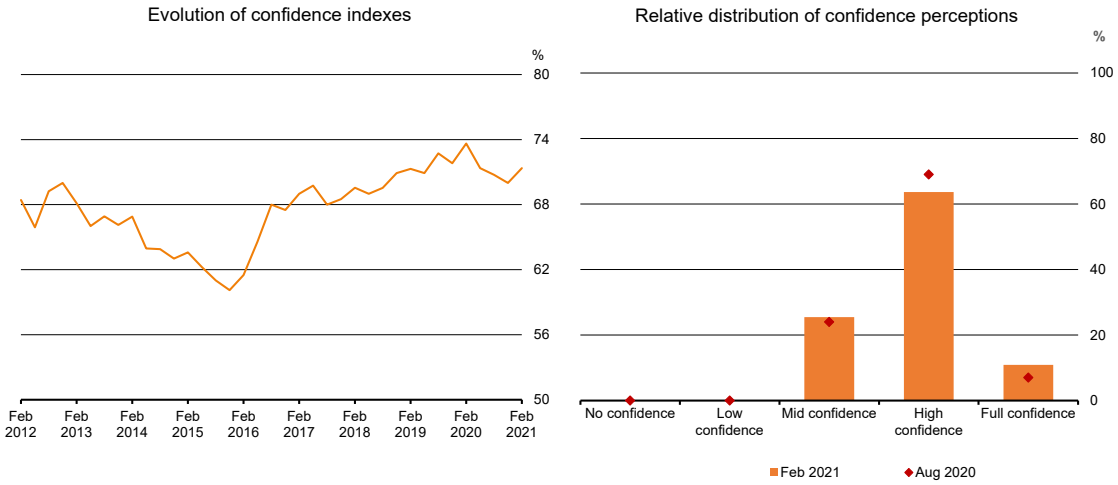
Financial system resilience factors	Aug 2020 (median)	Nov 2020 (median)	Feb 2021 (median)	Distribution (last survey)
Financial system capital adequacy	2	2	2	1 2 3 4 5 6
Financial system liquidity adequacy	2	2	2	1 2 3 4 5 6
Financial institutions monitoring and attention	2	2	2	1 2 3 4 5 6
Government and Regulatory Agencies monitoring and attention	2	2	2	1 2 3 4 5 6
Instrumental availbability for risk prevention and mitigation by the BCB	2	2	2	1 2 3 4 5 6

Median of the distribution of reaction capacities

Satisfactory 1 2 3 4 5 6 Unsatisfactory

Statistical annex

Chart 1.3.7 – FSS – Index of confidence in the stability of the financial system

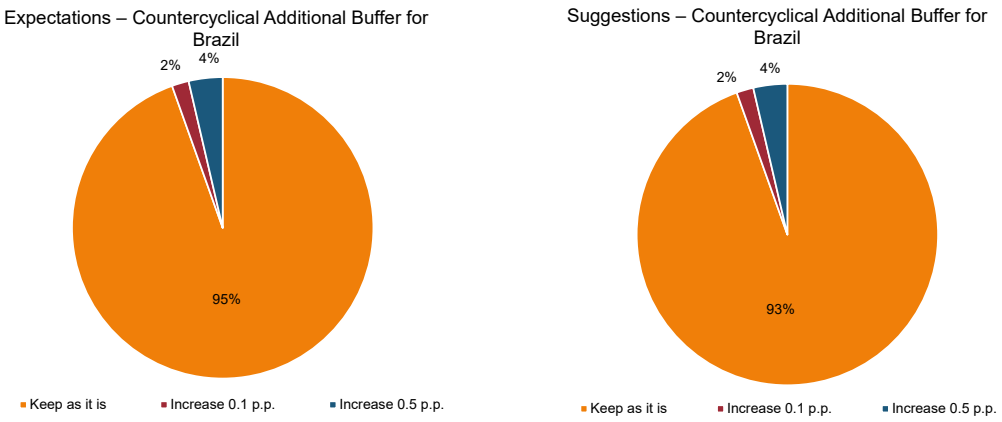


Statistical annex

Expectations for the Countercyclical Additional Buffer

Financial institutions expect ACCP$_{\text{Brasil}}$ at 0%. The ACCPBrasil is expected to remain at 0% for 95% of surveyed respondents (Chart 1.3.8). This percentage has been relatively stable during the surveys.

Chart 1.3.8 – FSS – Countercyclical Additional Buffer for Brazil



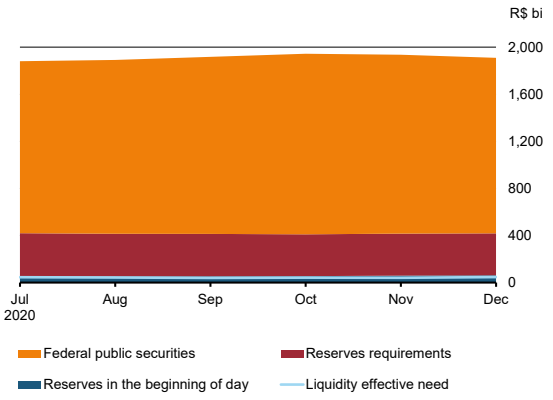
Statistical annex

1.4 Financial market infrastructures

In the second half of 2020, FMIs contributed to the safe and efficient functioning of markets. The systems were compliant to the normative requirements and to the applicable international principles.

The financial system held enough liquidity to ensure the smooth flow of payments in the Brazilian Payment System. Intraday liquidity[65] for payments[66] was abundant when compared to participants' needs. Risk of insufficient resources for settlement was extremely low. Reserves requirements alone were enough to guarantee smooth flow of payments and Brazilian Government Bonds (TPF) were the largest source of liquidity (Chart 1.4.1).[67] During the semester, the average need for funds to daily payments (NEL) was 2,3% of the total available liquidity, with a peak of 4.2%.

Chart 1.4.1 – Liquidity Potential and Effective Liquidity Needs



Statistical annex

65 The aggregated balance of funds available for payments and interbank transfers.

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

67 Reserve requirements balances can be transferred to the Reserves accounts, while TPFs can be converted into Central Bank money by means of repo operations, both without intraday financial cost to Financial Institutions.

The financial risks in financial assets, securities and foreign currencies market have been properly managed by the FMIs. B3 S.A. acts as CCP in two systems[68]: B3 Clearinghouse and B3 FX Clearinghouse. In both, the confidence level of the initial margin model is over than 99%, in line with the PFMI.[69] The Clearinghouse's stress scenarios were more severe than the observed price changes of the main Primitive Risk Factors (PRF) [70] in the period (Table 1.4.1). The margins required by B3 Clearinghouse were enough to cover the risk of a high percentage of the investors' portfolios, as determined by the BCB (Chart 1.4.2).

Table 1.4.1 – B3 Clearinghouse
Primitive Risk Factors (PRF)

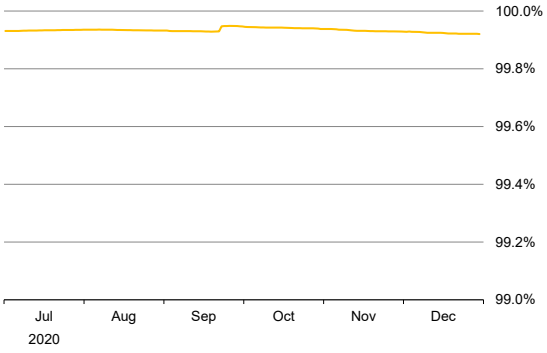
Discrimination	Low[1/]	High[1/]
Ibovespa spot	37%	33%
USD spot	42%	29%
Fixed rate 42	9%	5%
Fixed rate 126	13%	11%
Fixed rate 252	21%	17%
Fxed rate 756	23%	18%
DDI[2/] 180	10%	5%
DDI 360	12%	7%
DDI 1080	14%	7%

Sources: [B][3] and BCB

1/ Highest observed percentage in the second half of 2020 for the ratio between two-day accumulated return and the respective high or low scenario.
2/ Foreign exchange coupon.

Statistical annex

Chart 1.4.2 – 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.

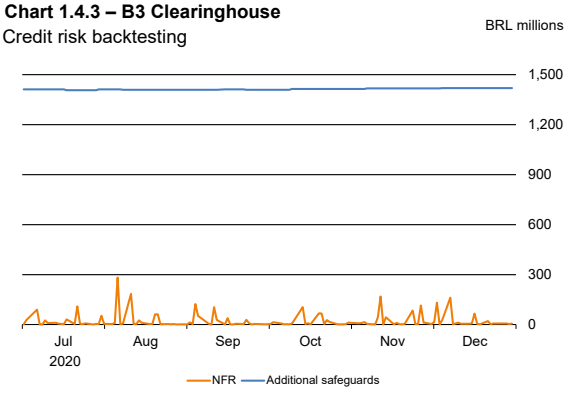
Statistical annex

Credit and liquidity exposures were adequately managed by the CCP throughout the whole period.[71] For the B3 Clearinghouse, prefunded additional resources would be sufficient to cover B3's credit exposure, which exceeds individual margins, against the two participants whose joint default would result in the highest aggregate credit exposure (Chart 1.4.3). The liquid resources maintained by the B3 Clearinghouse would be enough to ensure the timely settlement of obligations coming from the two participants with the largest debt net positions. For the B3 FX

68 B3, as well as CIP (C3) and BCB (Selic), operates other FMIs in the financial assets and securities markets. This text does not deal with these FMIs because neither the clearinghouses nor the BCB incur participant's credit and liquidity risks in these systems. In addition, participants in these systems do not incur principal risk because of delivery versus payment mechanism.
69 With respect to the estimated distribution of future exposure.
70 The primitive risk factor associated with a derivative contract is the name given to the financial variables that are relevant to the price formation of the derivative.
71 Backtesting indicate that B3 Clearinghouse and B3 FX Clearinghouse are complying with SPB legislation and PFMI objectives.

Clearinghouse, the collateral required would be enough to cover credit exposures against each of the participants. Liquid resources held by B3 FX Clearinghouse would be enough to cover the default of the participant with the largest obligation in Brazilian real (Chart 1.4.4) and in U.S. dollar (Chart 1.4.5).[72]

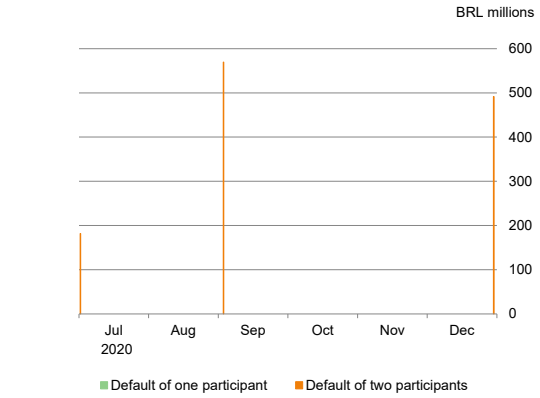
Chart 1.4.3 – B3 Clearinghouse
Credit risk backtesting



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

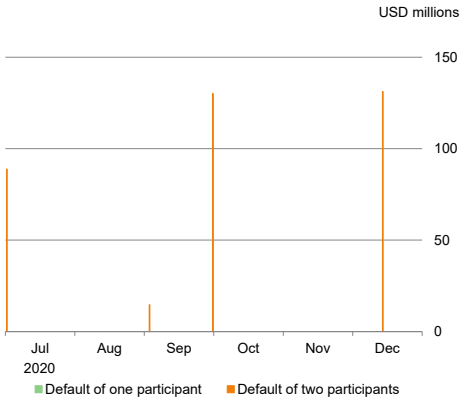
Statistical annex

Chart 1.4.4 – B3 FX Clearinghouse
Liquidity shortage in BRL



Statistical annex

Chart 1.4.5 – B3 FX Clearinghouse
Liquidity shortage in USD



Statistical annex

72 Principle 7 of the PFMI determines a) maintenance of sufficient liquid resources to settle the obligations arising from the default of the two participants and their affiliates in a timely manner, 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, and it does not have a complex risk profile and settles only dollar spot purchase and sale contracts, the events represented in Charts 1.4.4 and 1.4.5 are compatible with international recommendations.

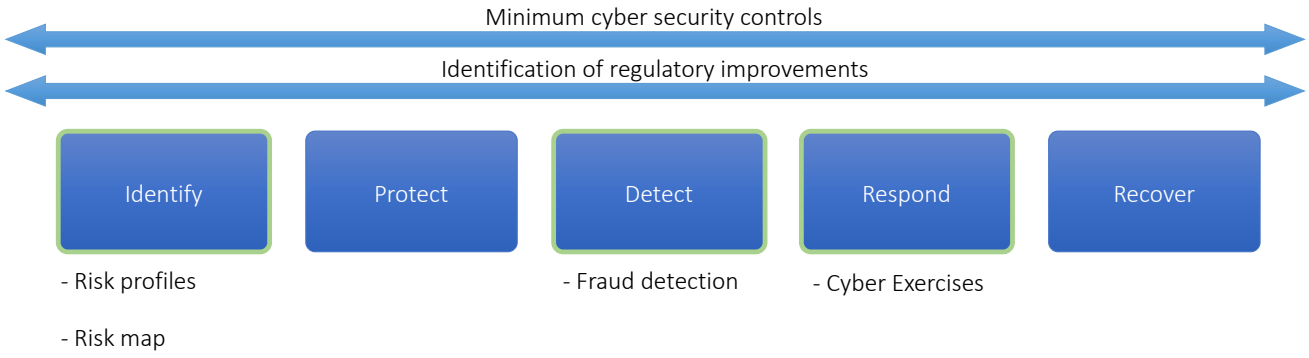
Selected Issues

2

2.1 Cyber Resilience Improvement Program of the National Financial System and the Brazilian Payments System

The BCB strengthens its actions aimed at improving the cyber resilience of the financial sector with the inclusion of Parc in the Agenda BC#. The BCB completed the "Improvement of the SFN cyber risk supervision" initiative in early 2021. This initiative was focused on enhancing supervisory tools and developing supervisory actions aimed at verifying the compliance of financial institutions with current cyber security regulations. However, the BCB was aware of the need to comprehensively address the implications of cyber risk and set up a working group to define a set of actions to be developed over the next 18 months, consolidated in Parc.

Figure 1 – Parc initiatives versus functions considered in the National Institute of Standards and Technology (NIST) framework for cyber security



Statistical annex

The BCB identified the need to comprehensively address operational and cyber resilience issues, as individually ensuring the soundness of institutions may not be enough to ensure the soundness of the financial system. It is increasingly important to promote integration between institutions and coordinate actions to mitigate the risk of the "weakest link", ensuring that all institutions improve their controls in proportion to their respective exposures to cyber risk. In addition, it is essential to manage the implications to FIs arising from events of unavailability of SFN critical services, such as the services provided by FMI.

The implementation of Parc aims at aggregating new capabilities to respond to cyber risk, allowing that the development of structuring projects enabled by technological innovations has no implications for the soundness of the SFN. In recent years, the BCB has already predicted that new threats to operational and cyber resilience would require continuous improvement of regulatory and supervisory frameworks to address changes in the operational profile of institutions arising from the digital transformation process and implement adequate mechanisms to respond to new cyber threats.

The year 2020 will certainly be remembered as a period of great transformations in the SFN. This year was marked by the challenges caused by a pandemic crisis of great implications and the transformation process triggered by the implementation of technologically innovative projects.

In a short period, financial institutions had to provide solutions to enable their workforce and customers to offer and demand services remotely. FIs had to invest in their telecommunications and information technology infrastructures, as well as develop or acquire solutions to provide financial services in a context of social distancing measures. The provision of financial services using digital channels has allowed the rapid implementation of government programs to support families and companies impacted by the health crisis.

Despite all the implications caused by the pandemic crisis, the year 2020 was also marked by structural transformations in the financial system. The initial operation of Pix was another step in a transformation process that will certainly take the SFN to a new stage, more technological, more efficient, and more accessible to citizens, thus materializing the desired financial democratization. Open Banking and the improvements to the collateral management environment are examples of projects intensively based on technology that will also shape the financial system of the coming decades.

Considering all coming changes, it is clear to the BCB that the success of these initiatives depends on strengthening the controls of FIs. FIs should continuously improve their controls and update their cybersecurity policies to adequately respond to increased exposure to technological and cyber risks. These institutions should also consider the changes in the external environment.

The report of cyber incidents in early 2021 highlights that the response to cyber risk is challenging and will require continuous improvement of cyber defense capabilities of FIs. The SFN players will deal with fraudsters increasingly equipped with information about financial services clients. The massive leakages of personal data of Brazilian citizens suggest a critical scenario – the use of information obtained illegally from other companies to perform frauds against the financial system.

The Parc aims to provide a systemic and integrated view on the exposure to cyber risk of SFN and SPB institutions. In addition, this program also targets to develop actions aimed at preventing and the responding to: (i) frauds in payments systems; (ii) cyber incidents that may result in the leakage of personal data or data protected by bank secrecy; and (iii) unavailability of critical functions and services for financial stability.

One of Parc's initiatives is the development of cyber risk profiles, enabling the creation of a map that consolidates the exposure of FIs to cyber risk. This map will allow the definition of actions focused on resolving possible gaps. These risk profiles will also allow the establishment of control requirements based on the cyber risk exposure.

Parc also includes initiatives to map fraud detection practices and controls, initially focusing on high-value payments systems. The improvement of fraud detection capabilities will enable the development of mechanisms for prevention as well as for responding to incidents that have occurred.

Another key initiative will be the establishment of practices to timely respond to severe cyber incidents, in line with international recommendations. Great advances have already been made with the participation of financial institutions in cyber exercises such as the Cyber Guardian, conducted by the Cyber Defense Command of the Brazilian Army. Parc aims at enhancing the capabilities regarding responding to cyber incidents by performing cyber exercises targeted to FIs, exploring scenarios that will demand the coordination of different institutions.

Given that cyber incidents are not limited to countries' borders, it is also important that the Brazilian regulatory framework remains aligned with best international practices. Regulatory fragmentation should be avoided, in such a way international cooperation to deal with cyber risk can occur without friction.

In this way, Parc actions also include the identification and definition of minimum cyber security controls in line with mapped risk profiles and best international practices. The latest advances on the subject, including discussions held in international bodies and industry best practices, will be considered throughout the development of Parc.

2.2 Pix security features

Pix is a new method of payment that allows the transfer of funds between transactional accounts[73], managed by different institutions or by the same institution, in an instantaneous, simple and safe manner, being available 24 hours a day, every day of the year.

Pix has three dimensions of security to ensure the integrity of transactions. The first relates to the user's digital authentication, the second deals with the safety of communications and the system's infrastructure and the third dimension refers to mechanisms for the prevention of fraud and the leakage of transactional data.

All these security dimensions were designed in conjunction with the Security Working Group (GT-SEG), which operates permanently within the scope of the Pix Forum[74] and which has the participation of the main security experts from the participating institutions of Pix.

It must also be pointed out that, even by any chance if there is fraud, all Pix transactions are traceable. The traceability of all transactions allows the swift action of police authorities to recover funds that may have been handled in a criminal manner.

Digital user authentication

Pix transactions can only be initiated in a secure environment that is accessed using a password or other security devices integrated into a cell phone, such as biometric and facial recognition. This requirement minimizes the risk of fraud, especially in e-commerce transactions. The provision of safety devices integrated with the telephone is the responsibility of the institutions participating in Pix. There is a growing supply and an increasing use of these solutions, which makes the process of Pix initiation even safer.

Security of communications and of the system's infrastructure

The transaction information traffic occurs under encryption in the RSFN. The RSFN is a network totally disconnected from the internet and through which all SPB transactions flow. All Pix participants must issue specific digital certificates to be able to transact on that network. In addition, all transactions are digitally signed by the issuer, and personal data linked to Pix keys[75] is stored encrypted in the BCB's internal systems.

The infrastructure that supports Pix allows a high performance of the system, while ensuring its security and resilience. To ensure high availability, scalability and resilience, all applications, services and components necessary for the operation of Pix have redundancy and work in a simultaneous and independent manner, on two different sites, presenting an elastic architecture, which may be expanded quickly in the event of a demand increase.

73 Transactional accounts include: demand deposit accounts, savings accounts and prepaid payment accounts.

74 The Pix Forum is the environment for discussions and for the coordination of the various market agents. The Forum's objective is to subsidize the BCB in the role of defining the rules for the operation of Pix.

75 A Pix key is information related to the holder of a transactional account (cell phone number, e-mail, CPF, CNPJ or a random alphanumeric code) that allows obtaining information about the receiving user and the user's corresponding transactional account (name and CPF/CNPJ of the beneficiary, institution in which the user holds an account, branch number, account number and account type).

Mechanisms for the prevention of fraud and leakage of transactional data

Four provisions in Pix regulation reinforce security to mitigate the risk of fraud:

- possibility of establishing maximum amount limits, based on the risk profile of their customers, by the participating institutions;

- presence of a variable maximum period for authorization of the transaction, by the participating institutions, in the case of unusual transactions initiated by their customers that have a high probability of being a fraud;

- provision by the BCB of an information centre, shared with all participants, on Pix keys, account numbers and Individual Taxpayer Registry (CPF) and Corporate Taxpayer Registry (CNPJ) that have been involved in any fraudulent transaction; and

- permission to generate a QR Code only for participants who send specific security certificates to the BCB.

All Pix participants also have their own fraud risk, operational risk and cyber risk mitigators, in addition to the security elements that involve the activities of the BCB.

From the perspective of the risk of fraud, all participants have risk engines to identify, prior to the authorization of the transaction, the risk score of each transaction. These engines can be developed internally or hired from companies specialized in this service. A reasonable amount of security solutions specialized in Pix may already be noticed in the market.

From the point of view of operational risk and cyber risk, all Pix participants must ensure compliance with CMN and BCB regulation pertaining to the operational and liquidity risk management structure, as well as to cybersecurity policy, plan of action and response to incidents, procurement of data processing and storage and cloud computing services.

Finally, **all Pix participants must also ensure compliance with the regulation regarding the policy, procedures and internal controls, aiming at the prevention of the use of the financial system for the practice of crimes of laundering or concealment of assets, rights and values,** in conformity with Law 9,613, of March 3, 1998, and the financing of terrorism, in accordance with Law 13,260, of March 16, 2016, as established in Circular 3,978, of January 23, 2020.

2.3 The impact of climate-related events on financial outcomes in Brazil

This section presents the main results of the article "Another Boiling Frog: The impact of climate-related events on financial outcomes in Brazil", which assesses the impact of climatic events on the Brazilian banking sector.

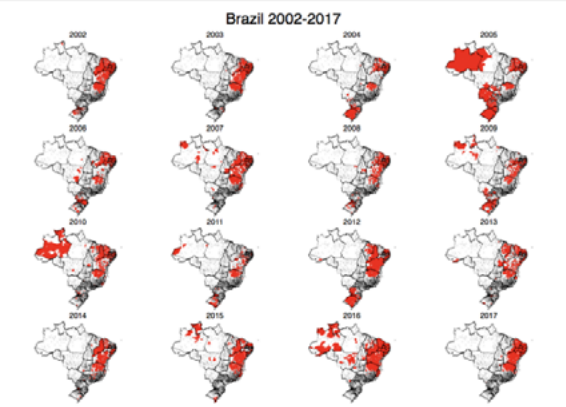
Evidence shows that enterprises and individuals are adapting to gradual climate changes. But, as usually described by the boiling frog fable, the greenhouse effects generate a slow rise in temperature without causing immediate reactions from affected populations. Simulation exercises suggest that climate change can have considerable economic impacts (MENDELSOHN, NORDHAUS e SHAW, 1994; STERN, 2006; DESCHENES e GREENSTONE, 2011; DELL,

JONES e OLKEN,2012 e 2014; WOOD e MENDELSOHN, 2015; ASSUNÇÃO e CHEIN, 2016; e outros),[76] as well as financial implications for markets and institutions (BATTEN *et al.*, 2016; NGFS, 2018).[77]

Climate physical risks derive from direct impacts of extreme events and of slow and chronic changes. These effects are related to agricultural productivity, food security and human health, as clarified by Deschenes e Moretti (2009) e Deschenes e Greenstone (2011). The impacts from transitioning towards a low carbon economy could become abrupt if not prepared and could be due to policy changes, technology changes and market behavior (NGFS, 2018).[78]

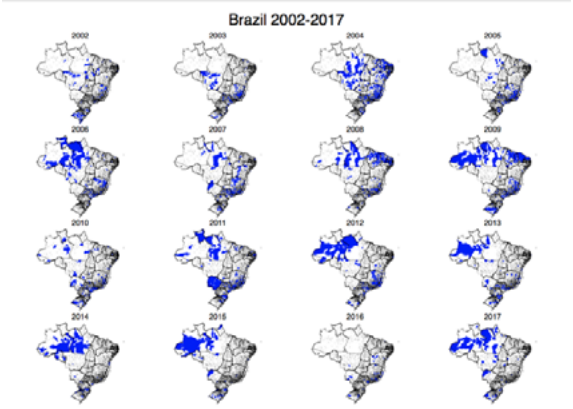
Short-run fluctuation in weather does not generate relevant impacts on deposits or credit in Brazil. The geographical distribution and the evolution over time of droughts and floods show a substantial variation that will be used in econometric analyzes (Figures 2.3.1 and 2.3.2). Quantitative analyzes based on regression models to characterize the importance of physical risks to the financial sector, examined the impact of weather fluctuations, droughts, floods and climate change on deposits and credit, in a sample at the municipal level covering the period of 2004-2017. Although temperature and precipitation are significant determinants of all financial results considered in the analysis, short-term fluctuation in the climate has limited effects.

Figure 2.3.1 – Distribution of droughts in Brazil



Statistical annex

Figure 2.3.2 – Distribution of floods in Brazil



Statistical annex

The reason for this limited effect is the result of the banks' adaptation mechanisms. Banks anticipate that some areas are more vulnerable to climate-related events and reduce credit exposure as a means of reducing non-performing loans; similarly, the economic activity seems to avoid these areas, determining reduction in deposits or demand for loans. Therefore, the indicators about deposits and credit amounts are more sensible to climate-related events than the indicator of non-performing loans.

The system's ability to adapt to the new risk profile reduces the scope of operations of financial institutions, mitigating substantial risks for National Financial System (NFS). Droughts and floods are considered as possible extreme events that can affect financial outcomes. Droughts allows to study adaptation mechanisms because they are

76 Assunção, J. J. and Chein, F. (2016). Climate change and agricultural productivity in Brazil: future perspectives. *Environment and Development Economics*, 21(5): 581-602.
Dell, M., Jones, B. F., and Olken, B. A. (2012). Temperature Shocks and Economic Growth: Evidence from the Last Half Century. *American Economic Journal: Macroeconomics*, 4(3):66-95.
Dell, M., Jones, B. F., and Olken, B. A. (2014). What Do We Learn from the Weather? The New Climate-Economy Literature. *Journal of Economic Literature*, 52(3):740-798.
Deschenes, O. and Greenstone, M. (2011). Climate Change, Mortality, and Adaptation: Evidence from Annual Fluctuations in Weather in the US. *American Economic Journal: Applied Economics*, 3(4):152–185.
Mendelsohn, R., Nordhaus, W., and Shaw, D. (1994). The impact of global warming on agriculture: a Ricardian analysis. *The American Economic Review*, pages 753-771.
Stern, N. (2006). *The Economics of Climate Change*. Stern Review, 662. https://doi.org/10.1257/aer.98.2.1

77 Batten, S., Sowerbutts, R. and Tanaka, M. (2016). Let's talk about the weather: the impact of climate change on central banks. *Bank of England, Staff Working Paper No. 603*.

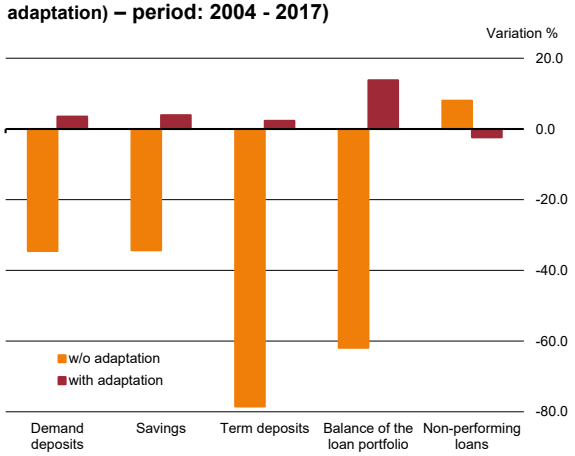
78 NGFS, 2018. First Progress Report, Central Banks and Supervisors Network for the Greening for the Financial System. Available at https://www.ngfs.net/en/first-progress-report.

primarily determined by natural conditions. They induce relevant reductions in the deposits and credit amounts in the affected municipalities when we do not consider possible adaptations. However, incorporating the possibility of adaptation from banks and the economy to the exposure of such risks, the occurrence of droughts is associated with almost no impact on deposits and defaults and a small increase in the credit portfolio (Chart 2.3.1). These two pieces of evidence suggest that, as climate change increases the occurrence of droughts, it can reduce the overall scope for banking business due to the adaptation of the system to the new risk profile. In counterfactual exercises, we show that the current occurrence of droughts does not create a substantial aggregate risk to the Brazilian banking system. Floods, which are usually a combination of strong rainfalls with conditions for water accumulation, such as urbanization, do not allow us to study adaptation mechanisms. For this reason, in the analysis of flood events, only the impact on municipalities over time was assessed, considering the possibility of adapting banks and the economy. The results reinforce the message obtained in the analysis of droughts, in which the occurrence of such events have a relatively small impact on financial outcomes.

The aggregate effect of short-term weather fluctuation or extreme events has a limited impact on both public and private banks; however, defaults are substantially higher for state-owned banks. As in many other countries, the banking sector in Brazil comprises both private and public players. Considering the case of droughts, private banks reduce their exposure to most vulnerable areas more drastically, as a way of mitigating the impact of droughts on non-performing loans. For the case of state-owned banks, adaptation is smoother than the observed by private players. Therefore, the impact of the occurrence of droughts on non-performing loans is much higher for state-owned banks. The occurrence of droughts increases the local amount of loans, suggesting credit is being used as a mechanism for mitigating possible consequences on consumption and/or production.

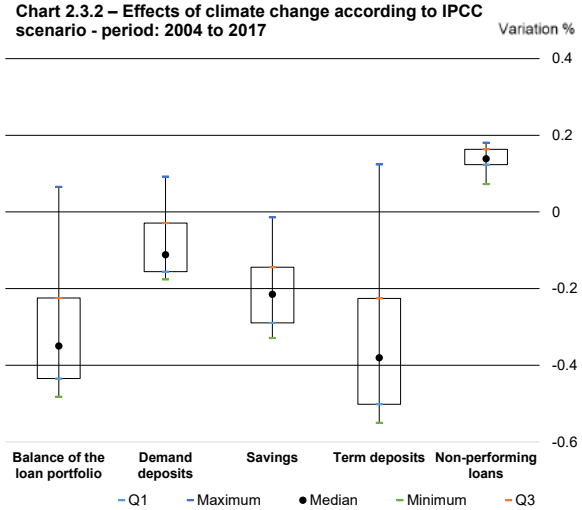
On the other hand, the impact of climate change, according to the IPCC[79] climate change scenario, reduces the volume of credit by about 20% and increases the default rate by 12%. In a third step to assess the impact of climate change on the NFS, models for the long-term impact of temperature and rainfall on financial results were estimated and the scenarios proposed by the IPCC were applied. Under this scenario, a structural change in temperature and rainfall is expected to create substantial impacts on the financial system. Under the IPCC scenario, deposits are expected to fall, in the aggregate figures, by a range of 3% to 22%. Credit is expected to reduce in about 20% and delinquency rates are expected to rise 12% (Chart 2.3.2). Thus, a climate change scenario with sustained and long-term changes, unlike short-term changes and extreme events, can have significant impacts on the banking sector.

Chart 2.3.1 – Local Impacts of Droughts on Financial Outcomes (scenarios with and without adaptation) – period: 2004 - 2017)



Statistical annex

Chart 2.3.2 – Effects of climate change according to IPCC scenario - period: 2004 to 2017



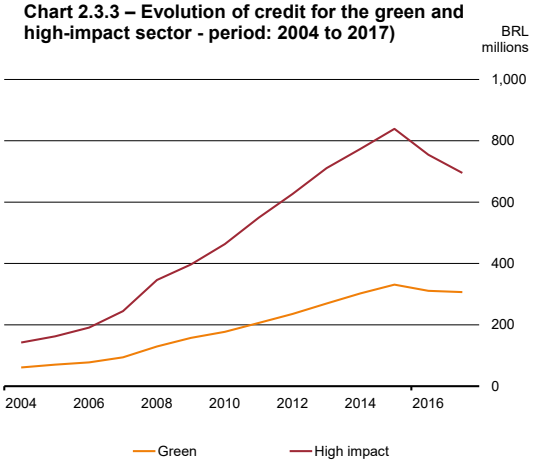
Statistical annex

The share of the portfolio allocated to green sectors is smaller than the share allocated to high impact sectors; however, this distance is narrowing consistently. The analysis of transition risk relies on a project developed at the

79 The IPCC is a scientific organization created by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP).

Brazilian Federation of Banks (Febraban) that classifies sectors into two groups: sectors associated with sustainable practices (green sectors) and sectors with potential to cause socio-environmental impacts (high impact sectors). Loans to both green and high impact sectors grew consistently from 2004 to 2015 (Chart 2.3.3). In 2016 and 2017 this trend was reversed due to the economic crisis.

Chart 2.3.3 – Evolution of credit for the green and high-impact sector - period: 2004 to 2017)



Statistical annex

Understanding how climate risks affect the financial system is important for policy design. The evidence on how climate-related events affect financial markets is increasing, however there's not enough quantitative evidence of how such risks impact the ability of financial institutions to lend to potentially vulnerable actors, while remaining financially solid. As a new climate scenario emerges, the global economy and governments must be ready to act to mitigate and adapt, designing a new generation of policies. A failure to adequately price the additional risks associated with climate change in the current financial operations, could substantially affect the performance of financial institutions and therefore create economic consequences for the entire economy. There is a growing concern about the relationship between climate-related risks and financial systems in developed and emerging markets (BATTEN, SOWERBUTTS e TANAKA, 2016; CHRISTOPHERS, 2017; PADDAM e MACKENZIE, 2016; FRISARI *et al.*, 2019; KLING *et al.*, 2018).[80]

Brazil is an interesting case study. The study of climatic effects on Brazil corresponds to a study of great interest for the following reasons: (i) as the fifth largest territory in the world, Brazil depicts a large variety of climate conditions, an essential feature for evaluating the consequences of climate-related episodes; (ii) being a developing country, it provides lessons that may apply to a large set of vulnerable regions; (iii) the availability of detailed information on financial flows, it is possible to characterize the impact of climate-related events on different aspects of the banking sector.

80 Batten, S., Sowerbutts, R. and Tanaka, M. (2016). Let's talk about the weather: the impact of climate change on central banks. *Bank of England, Staff Working Paper No. 603*.
Christophers, B. (2017). Climate Change and Financial Instability: Risk Disclosure and the Problematics of Neoliberal Governance. *Annals of the American Association of Geographers*, *107*(5), 1108–1127. https://doi.org/10.1080/24694452.2017.1293502.
Frisari G, Monnin P., Nakano C., Cardenas V., and Gallardo M. (2019) Climate Risk and Financial Systems of Latin America: Regulatory, Supervisory and Industry Practices in the Region and Beyond. InterAmerican Development Bank. Available at https://publications.iadb.org/en/climate-risk-and-financial-systems-latin-america-regulatory-supervisory-and-industry-practices.
Gerhard Kling, Yuen Lo, Victor Murinde and Ulrich Volz, 'Climate Vulnerability and the Cost of Debt,' mimeo, London: SOAS University of London, 2018. https://papers.ssrn.com/sol3/papers. cfm?abstract_id=3198093.
Paddam, S. & Mackenzie, K., 2016. Climate change impact on financial institutions. *The Actuary*, p.1–6. Available at: http://www.theactuary.com/features/2016/07/climate-change-impact-on-financial-institutions/.

Appendix

Banco Central do Brasil Management

Acronyms

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

Fábio Kanczuk
Deputy Governor

Fernanda Feitosa Nechio
Deputy Governor

João Manoel Pinho de Mello
Deputy Governor

Maurício Costa de Moura
Deputy Governor

Otávio Ribeiro Damaso
Deputy Governor

Paulo Sérgio Neves de Souza
Deputy Governor

Acronyms

$ACCP_{Brasil}$	Countercyclical Capital Buffer
$ACP_{Sistêmico}$	Systemic Buffer Requirement
Anatel	National Telecommunications Agency
AP	Problem asset
APT	Advanced Persistent Threat
ATM	Automatic teller machine
$[B]^3$	Brasil, Bolsa, Balcão
BCB	Banco Central do Brasil
BCBS	Basel Committee on Banking Supervision
BNDES	Brazilian Development Bank
BRL	Brazilian Real
CBI	Climate Bonds Initiative
CCP	Central counterparty
CDB	Bank Deposit Certificate
CET1	Common Equity Tier 1
CGPE	Program of Working Capital for the Preservation of Firms
CI	Coverage index
CIS	Center for Internet Security
CMN	National Monetary Council
CNAE	National Classification of Economic Activities
Comef	Financial Stability Committee
Copom	Monetary Policy Committee
Covid-19	Corona Virus Disease – 2019
CSLL	Social Contribution on Net Profit
DFAST	Dodd-Frank Act Stress Testing
DI	Interbank deposit
DPGE	Term Deposit with Special Guarantee
DTA	Deferred tax asset
EMBI+ Br	Brazil´s Country Risk Premium, calculated by J.P. Morgan Chase
FED	Federal Reserve
FGC	Deposit Insurance Fund
FGTS	Length-of-Service Guarantee Fund
FI	Financial institution
FMI	Financial market infrastructure
FPR	Risk-weighting factor
FSAP	Financial Sector Assessment Program
FSR	Financial Stability Report
FSS	Financial Stability Survey

FX	Foreign exchange
GDP	Gross Domestic Product
GPS	Supervisory Practices Guide
IBC-Br	Index of Economic Activity of the Central Bank
IBGE	Brazilian Institute of Geography and Statistics
IL	Short-Term Liquidity Ratio
ILE	Structural Liquidity Ratio
INSS	National Social Security Institute
IPCA	Extended National Consumer Price Index
IRPJ	Corporate Income Tax
IS	Information security
ISO	International Organization for Standardization
IT	Information technology
IVG-R	Residential Mortgage Collateral Value Index
LCA	Agribusiness Credit Bill
LCR	Liquidity Coverage Ratio
LFG	Financial Letter with Guarantee
LLP	Loan-Loss Provisions
LR	Leverage ratio
LTEL	Special Temporary Liquidity Line
LTV	Loan-to-value
MSME	Micro, Small and Medium Enterprise
NDPGE	New Term Deposit with Special Guarantee
NEL	Effective Liquidity Need
NFR	Net Financial Risk
NII	Net interest income
NIST	National Institute of Standards and Technology
NSFR	Net Stable Funding Ratio
OTC	Over the Counter
PCI DSS	Payment Cards Industry Data Security Standard
Peac	Emergency Credit Access Program
Pese	Emergency Employment Support Program
PFMI	Principles for Financial Market Infrastructures
PNADC	Continuous National Household Sample Survey
p.p.	Percentage point
Pronampe	National Program to Support Micro and Small Businesses
RC	Regulatory capital
RDB	Bank Deposit Receipt
ROE	Return on equity
RWA	Risk-weighted assets
SCR	Credit Information System
Selic	Domestic interest rate
Selic	Special System for Settlement and Custody
SFN	National Financial System
SGS	Time Series Management System
SME	Small and Medium Enterprise
SOC	Security operation center
SPB	Brazilian Payments System
STR	Reserves Transfer System
TPF	Federal public security

USA	United States of America
USD	United States Dollar
VAR	Autoregressive vector
VPN	Virtual Private Network
YoY	Year-over-year

Annex

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.

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 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).

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.

Scenarios 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); 5) Brazil's country risk premium (EMBI+Br spread, calculated by J.P. Morgan Chase); 6) the 10-yr US Treasury Yield; 7) unemployment rate (calculated by the IBGE based

upon the Continuous National Household Sample Survey – PNADC); and 8) commodities index (CRB index, calculated by Thomson Reuters/Core Commodity). All variables are measured as a 3-month average.

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. On the other hand, the path of the 10-yr US Treasury Yield is defined according to the adverse scenario published by the Board of Governors of the Federal Reserve System in the report "2018 Supervisory Scenarios for Annual Stress Tests Required under the Dodd-Frank Act Stress Testing Rules and the Capital Plan Rule".

The Structural Break scenario is obtained by verifying the historic periods in which each variable showed the greatest change (either positive or negative) through an eight-month interval. In each identified period, it is added the subsequent four quarters to form the total projection horizon (three years). Then, the changes between each quarter are calculated and applied onto the observed values of the variables in the reference date.

In the Worst Historical scenario, repetition of the macroeconomic variable's behavior is simulated, through a six-quarters rolling window since July 2003. Each window is plugged into dynamic panel data models and the historical scenario is the one with the lowest earnings before taxes.

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
6. 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 of 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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