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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 Central Bank of Brazil.

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Preface

The Financial Stability Report (FSR) is a semiannual publication issued by the Central Bank of Brazil (BCB) that presents recent developments and the outlook on financial stability in Brazil, focusing on the main risks, on the measures underway to mitigate those risks, and on the assessment of the domestic financial system resilience. The current edition covers the first half of 2018, highlighting more recent events when relevant.

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 comprises two chapters. Chapter 1 – Financial system overview – presents an analysis of risks related to liquidity, credit, profitability and solvency, of capital stress tests and their effects on the solvency of financial institutions, of the Financial Stability Survey (FSS) results, and of systemically important financial market infrastructures operation. Chapter 2 – Selected issues – discusses relevant but not necessarily recurring 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, <<http://www.bcb.gov.br/?fsr>>, as well.

Moreover, important time series for financial stability monitoring (e.g. total capital ratio, short term liquidity ratio, delinquency ratio, 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

In the first half of 2018, economic activity grew at a slower pace than in the second half of 2017. The gradual recovery of the economy, combined with the fall in inflation and in the Brazilian benchmark interest rate (Selic), led to a nominal increase of 1.3% in bank loans, with different effects on portfolios: a 2.7% increase in household loans and a 0.4% decline in corporate loans.

The improvement in credit risk indicators – with a decrease in the level of problem assets – led to a significant reduction in provisioning expenses, increasing the profitability and the resilience of the banking system to face stress scenarios.

The Financial Stability Survey (FSS) results reinforce market confidence in the financial system's ability to absorb shocks and show that the electoral process, the forthcoming administration's agenda, and the international environment should dominate the debate about financial stability risks over the second half of 2018 and early 2019.

The corporate credit market shows signs of improvement. The level of problem assets of large corporations in banks portfolio declined after three years of rising, but still remains at a high level.

- With the decline in Selic, a number of non-financial corporations have turned to the capital market for cheaper funding than bank loans and international issuances, thereby reducing the risk of these borrowers.
- Indicators of cash flow and profitability of non-financial corporations improved. The applications for judicial recovery, in turn, resumed.
- Despite the recent increase in interest rates in advanced economies and the currency appreciation in these countries, there is no scarcity of resources for Brazilian non-financial corporations in the international market. In addition, the foreign currency debt of companies without any type of foreign exchange hedge is only 3.0% of GDP.
- The non-earmarked credit portfolio shows a growth trend both in small and medium-sized enterprises (SMEs) and in large corporations. The SME's problem assets index continues to decline, and the index for large corporations' problem assets showed a slight reduction after three years of strong growth. However, both remain high.

Bank credit to households has been pushing forward since the beginning of 2017, with a concomitant perception of reduction in the portfolio risk.

- Over the last few years, the lower levels of debt servicing obligations relative to income and of household indebtedness have been positively influenced by the reduction of unemployment, the improvement in household income, and the decline in inflation and interest rates. This had a more pronounced impact on consumption-related loans such as vehicles financing, payroll-deducted loans, and credit cards.
- So far, the resumption of credit growth to households occurs without signs of increase in credit risk to financial institutions. Problem assets decreased or remained steady throughout the first half of 2018 in all household credit modalities.

- With further improvements in economic conditions, the recovery of credit to households should continue over the second half of 2018.

Banks' profitability has improved, mainly thanks to the significant decrease in loan-loss provisioning. The level of provisions of the loan portfolio remains adequate to its risk profile.

- Despite the slight growth in the loan portfolio, the gross revenue rate (securities and loans) declined from 12.7% to 11.7% in the first semester, due to the continuing reduction in interest rates on securities and on new loans.
- Nevertheless, the drop in loan-loss provisioning resulting from the reduction in credit risk and efficiency gains improved banks' profitability.
- As in previous periods, the level of loan loss provisions compared to the problem assets portfolio remains comfortable, in line with the risk profile of the loan portfolio, without risks to financial stability.
- In the coming semesters, it is expected a stable level of provisioning expenses and a deceleration of profitability increases, but still in favorable conditions for the evolution of the Return on Equity (RoE).
- The number of institutions with net loss has decreased in the first half of the year. Smaller institutions with business models focused on securities trading and loans to large corporations face more challenges to restore their profitability to pre-recession levels.

The banking system has robust capital, in quantity and quality, is fully compliant with Basel III rules, and is able to withstand the growth trend of the credit portfolio.

- All capital adequacy ratios remain well above that required by regulation. These ratios reduced in the first semester reflecting mainly the gradual credit recovery and prudential adjustments. It is noteworthy that, until end 2017, these ratios were rising due to banks deleveraging process.
- Simulation by the Central Bank of Brazil (BCB) indicates a smooth transition into fully-fledged Basel III framework, as it occurred with the implementation of the Leverage Ratio (LR) in 2018. Institutions that represent 99.9% of the banking system's assets possess a projected Common Equity Tier 1 (CET1) capital ratio above the minimum 7.0% that will be required from 2019.

Short- and long-term liquidity risk is low and this scenario tends to continue in the second half of 2018. The cost of funding from abroad has increased.

- The effects of the gradual resumption of credit were offset by the reduction in required reserves on demand and savings deposits from April 2018, thereby contributing to the stability in the level of liquid assets in the semester.
- All banking conglomerates required to comply with the Liquidity Coverage Ratio (LCR) have ratios above 100%, a level that will be required only from January 2019 onwards. Regarding structural liquidity (over the long-term), banks that represent 96% of the system's assets showed, in June 2018, balance sheet positions that mitigate liquidity risk in the long-term.
- Although there has been a rise in the cost of foreign funding due to the international scenario, the external funding dependence is low, and Brazil's financial institutions have accessed external credit in sufficient amounts to meet their domestic needs.

The capital stress tests results continue demonstrating the resilience of the banking system, which is able to absorb the estimated losses in all the simulated scenarios.

- Tests in scenarios where unemployment, Selic, exchange rate, inflation, economic activity, US interest rate are in stress levels indicate that the problem-assets' portfolio would reach 10.1% of total credit portfolio, in the worst scenario. The estimated capital needs fell to only 0.5% of regulatory capital.
- The results of sensitivity tests to abrupt exchange rates shocks indicate negligible impact on regulatory capital.
- However, the results were more sensitive to sudden shocks in Selic than in the previous semester. An abrupt increase of 100% in the Selic rate would imply a capital need of 8.8% of the regulatory capital, which represents an increase in risk given the current scenario of market volatility, both domestic and international.
- The sensitivity to credit risk shocks indicates that, even in the most extreme scenario simulated, with problem-assets peaking at 18.3%, well above its 7.6% in June 2018, there would be a need of capital equivalent to 4.1% of the system's regulatory capital, a reasonably comfortable situation. The simulation of sensitivity to reductions in residential property prices demonstrates that there would be no non-compliance and/or restrictions on dividend distribution in case of drops in nominal prices of up to 35%.
- In addition to the stress tests, the simulation of direct interbank contagion suggests a low need of resources for recapitalizing the system in case of contagion from each institution individually. In the worst scenario, the capital needs would amount to less than 1% of the system's regulatory capital.

The systemically important financial market infrastructures worked efficiently throughout the first half of 2018.

- The effective liquidity need of the system was, on average, 1.8% of the available intraday liquidity, being 9.0% the maximum in the period.
- The backtesting analyses for the clearing and settlement systems of securities, derivatives, and foreign currency transactions in which there is an entity acting as a central counterparty have presented satisfactory results.

The allocation of financial resources held by the real sector of the Brazilian economy has been changing since 2016 and that has gradually altered the attribution of risk exposures within the system.

- Households and firms have been investing in investment fund shares and passing over banking funding instruments. From the investors' standpoint, investments in funds became more attractive due to the reduction in returns on securities issued by banks; from the banking system's standpoint, the available liquidity and the evolution of the credit portfolio have demanded less funding resources.
- As investment fund quotas are marked-to-market daily, investors take greater risk of price volatility of these assets. In a stress scenario, they are subject to interest rate shocks. The reaction of investors to volatility in the returns of their investments may generate a redemption movement that feeds back onto itself.
- Nevertheless, the effects of such a stress scenario are greatly mitigated by the available liquidity in the investment funds. In addition, as shown in the most recent FSR, the risk stemming from interconnectedness within the Brazilian financial system is low, despite the dense network of direct connections between the banking system and investment funds, and between investment funds and pension funds.

The reduction in the Selic rate from 2016 to 2018 led to changes in the structure and in the credit market to non-financial corporations.

- The cost of corporate funding has declined. Market conditions have allowed companies to settle their debts and replace them with credit lines with more favorable interest rates. Indeed, from the second half of 2017, there was an increase in prepayment of debts, mainly fixed-rate operations.
- Domestic demand for private securities has increased. Risk premiums fell, thereby reducing the cost of funding for corporations in the capital market. This allowed a number of companies to exchange bank loans and international issues for private securities.
- Non-financial corporations' foreign debt measured in US dollars remained stable despite the fall in the interest rate differential with developed countries. This shows that the interest of foreign investors in corporate bonds of Brazilian companies did not change significantly.

The Central Bank of Brazil (BC) and the National Monetary Council (CMN) continue promoting the resilience of the National Financial System (NFS) both to increase its efficiency and safety and to its greater compliance with international regulatory standards. In this sense, the following measures stand out:

- Bilateral margin requirement for non-centrally cleared derivatives. Bilateral margin requirements consist of the exchange of financial instruments between counterparties of an OTC derivative transaction in order to protect them from losses caused by the inability of one counterparty to honor its financial obligations related to the transaction.
- Regulated institutions are required to implement cyber security policy. They must provide information to the BCB about their relevant services contracts for data processing and storage, and cloud computing. This information will allow the BCB to map the NFS cloud services network and to identify any existing systemically important dependency on IT services providers.

In July 2018, the National Command for Cyber Defense of the Ministry of the Defense developed and conducted the first national simulation exercise on cyber incidents.

- The exercise focused on the defense, the financial, and the eletronic sectors. For the financial sector, the exercise was composed of the application of scenarios in a virtual simulator, which comprehended denial-of-service attacks, sabotage, information leakage, fraudulent modification of systems and web pages, fake news, compromises to integrity of databases, among others.

Unfolding of topics/risks analyzed in previous FSRs

Exposure of the banking sector to subnational entities and potential impacts to financial stability

Regarding the NFS's exposure to subnational entities, the results of the impact simulation continue suggesting a low risk to financial stability. On the same basis of comparison, the results show a reduction in risk compared to the previous FSRs. The system is adequately capitalized to withstand a default of the states and municipalities classified as C or D by the National Treasury Secretariat, which are those ineligible for guarantees from the Federal Government, as well as its civil servants, suppliers, and employees of the suppliers.

Real estate loan restructuring

There was no significant change in the process of repossession of properties posted as collateral. Financial institutions continue facing difficulties in selling repossessed real estate. However, the stock of real estate repossessed represents only 1.3% of the real estate loan portfolio.

Rules for revolving credit card operations adopted by the BCB in early 2017 under the BC + Agenda

- After a period of adaptation by financial institutions and customers, the average rate of payment of the credit card bill increased from 71.6% in December 2016 to 77.0% in May 2018.
- The gradual recovery of the economy was reflected in increases in “sight” credit card purchases (those with a single debit entry in the card balance) – in line with the resumption of household consumption – and in operations in installments from revolving credit. These operations were boosted by the availability of credit lines for payment in installments under better conditions for the customer than the conditions of the revolving credit card balances. Within these balances, those in the past one month modality lost relative share in total credit card operations.

Financial Stability Committee’s decisions on the Countercyclical Capital Buffer

The Financial Stability Committee (Comef) has decided in its quarterly meetings held on June 7th, 2018, and on September 4th, 2018, to keep the Countercyclical Capital Buffer for Brazil (ACCPBrasil) at 0% (zero percent) ¹. Both decisions were taken by Comef in the exercise of its duties provided by Circular 3,827, of January 30th, 2017. They also followed the objectives and procedures described in Communiqué 30,371, issued on the same date. The decisions reached a consensus among Comef members in both occasions.

¹ Communiqués 32,139 (June 7th, 2018) and 32,516 (September 4th, 2018).

Financial system overview²

1.1 Liquidity

The banking system's liquidity risk remains at low levels and this scenario tends to continue during the second half of 2018. The opposite effects of the gradual resumption of credit granting since second half of 2017 and, on the other hand, the decrease of required reserves related to demand and saving deposits in April of 2018³ contributed to maintain the level of liquid assets constant in the first half of 2018, buffers that are adequate to withstand cash outflows under stress scenarios in the short term. The long-term liquidity risk remains stable and at an appropriate level. Thus, the banks' current balance sheet structures minimize their susceptibility to future liquidity problems, and, therefore, under different perspectives, the liquidity risk of the system remains not a relevant concern.

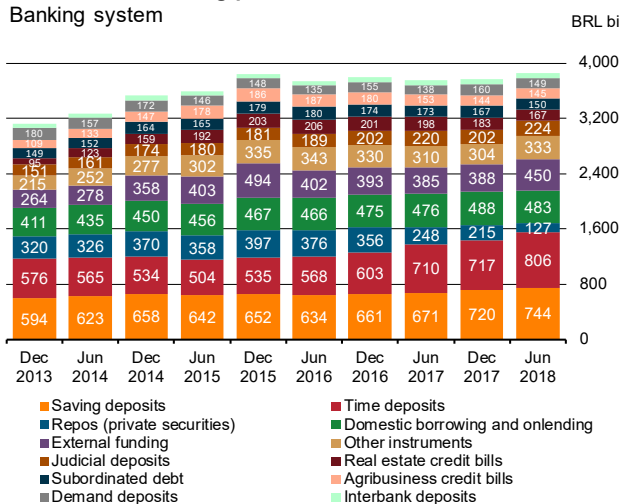
Funding has presented a slight growth over the first half of 2018, which turns into stability when external funding values are adjusted to make up for the fluctuation of the Brazilian Real versus the U.S. Dollar. Time deposits are still absorbing part of the reduction in the stock of repurchase agreements collateralized by securities issued or endorsed by institutions within the same prudential conglomerate (due to the edition of Resolution 4,527 on 9/29/2016), and savings deposits have posted a positive net fundraising in the first half of 2018 – as well as over the entire year of 2017, after negative results in 2015 and

2/ Please note that, within sections 1.3 Profitability, 1.4 Solvency and 1.5 Capital stress tests, the granularity of the analysis is in the level of prudential conglomerates, as defined by Resolution no. 4,280, from October 31, 2013, to which the minimal capital requirements are applied, as stated by Resolution no. 4,193, from March 1, 2013. In sections 1.1 Liquidity, the basis of the analysis is the whole banking system, comprised by Commercial Banks (CB), Multiple Banks (MB), FX Banks and Investment Banks (IB) and by financial conglomerates including at least one of these types of institutions. In 1.2 Credit, the scope is the whole SFN.

3/ According to Circular nº 3,888 and nº 3,890, of March 23, 2018, released under pillar "More Affordable Credit" of Agenda BC+.

Chart 1.1.1 – Funding profile

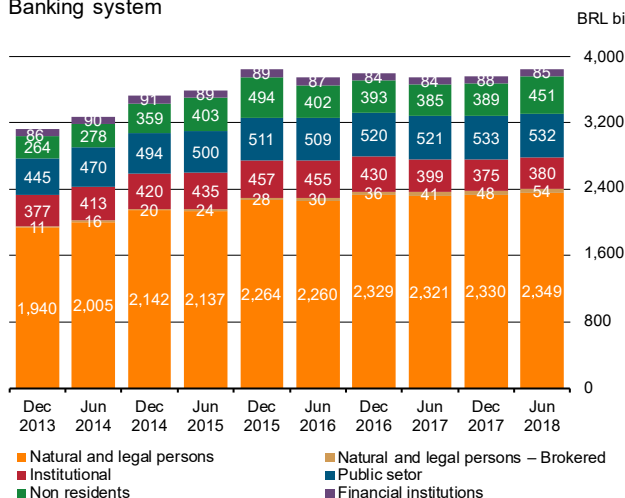
Banking system



[Statistical annex](#)

Chart 1.1.2 – Funding profile by type of investor

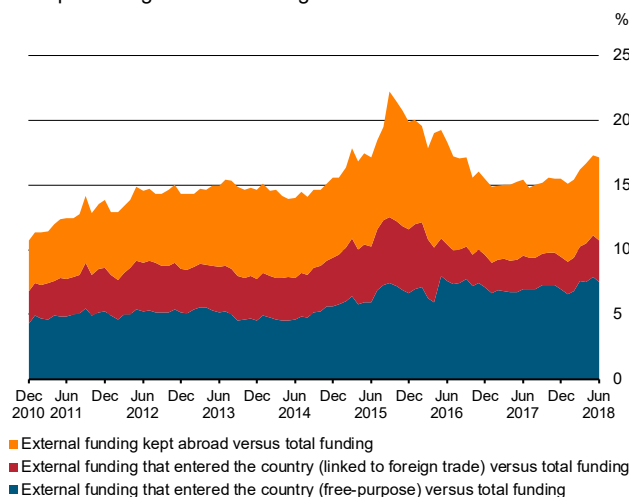
Banking system



[Statistical annex](#)

Chart 1.1.3 – Profile of external funding

As a percentage of total funding



2016. The stability of funding via agribusiness credit bills (LCA) and the decrease via real estate credit bills (LCI) is due to a shift by the main issuers to cheaper means of funding (Chart 1.1.1)⁴.

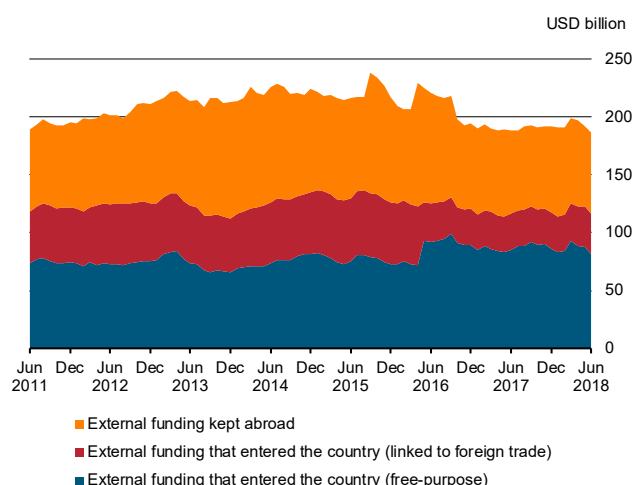
Funding profile by type of investor (Chart 1.1.2) shows the prevalence of natural and legal persons not classed otherwise⁵, who provided 62% of the outstanding amount of funding in June 2018. In spite of representing a little more than 1% of the total on that date, funding provided by natural and legal persons via brokering has been growing steadily for 4 years (12% in the first half of 2018 alone), which by broadening the customer base to which small and medium-sized financial institutions have access, allows longer maturity issues and reduces their dependence on professional asset management resources (although increasing some institutions dependence on the brokers themselves). Representing 10% of the total in June 2018, institutional investors funding (including mutual funds) increased 1% in the first half of 2018, after having steadily decreased since December 2015, and funding from the public sector is almost entirely linked to the brokering of government loans or credit lines.

Offshore funding dependence is low and its share in total funding had slight growth as a result of the devaluation of the Brazilian Real in the first half of 2018. However, in foreign currency, there was a small reduction in the total balance at the end of the semester compared to the previous semester, basically as a result of the decrease in the amount of funds kept abroad (Charts 1.1.3 and 1.1.4). The external funding internalized in the domestic market reached the amount of BRL 450 billion, of which BRL 134 billion were allocated in lines related to export, import or onlendings. The financial institutions had access to external credit in a volume sufficient to meet domestic needs, in both free-purpose and trade finance lines. This situation is expected to continue in the next semester, with funding costs rising due to the international conjuncture and the internal uncertainties of the electoral period.

4/ Time deposits: certificates of deposit, receipts of deposit, time deposits with special guarantee by the Credit Guarantee Fund (FGC in the Portuguese acronym). Subordinated debts: subordinated certificates of deposit, subordinated financial notes and other capital instruments. Other instruments: structured notes, bills of exchange, financial notes, mortgage notes, box spread strategies with options. Repurchase agreements (repo): refers only to repo collateralized by private-issued securities. Repo collateralized by the Brazilian federal government securities were not considered into the funding concept used in this report, as they are operations by which banks exchange liquidity.

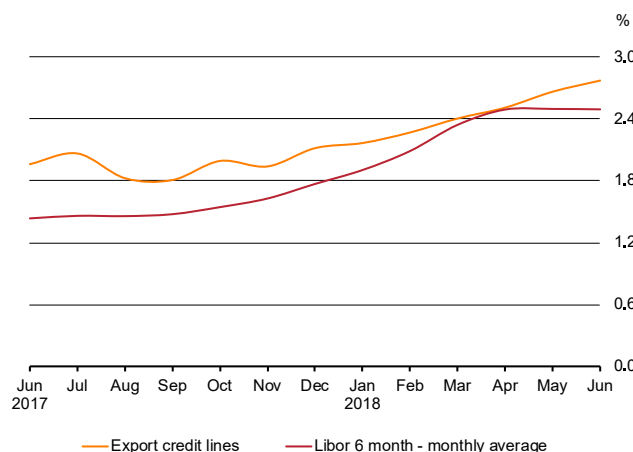
5/ Definition comprising not only companies, but other entities (such as non-profit ones) as well.

Chart 1.1.4 – Profile of external funding
Absolute amounts in dollars



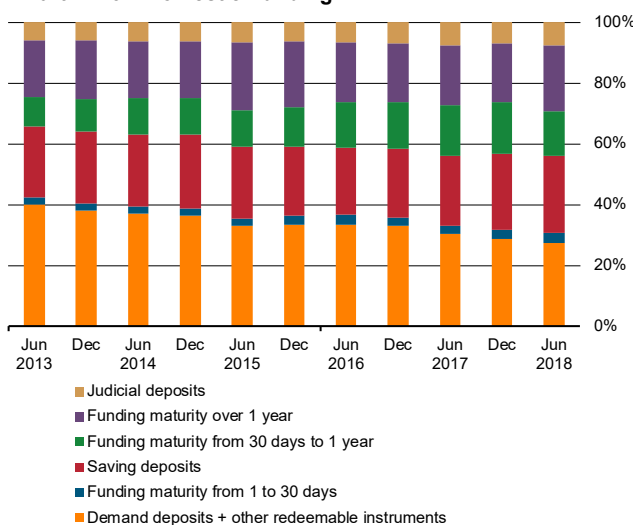
[Statistical annex](#)

Chart 1.1.5 – External credit lines for export
Interest rates



[Statistical annex](#)

Chart 1.1.6 – Domestic Funding



[Statistical annex](#)

The cost of external funding based on a basket containing the major currencies traded in Brazilian exports (USD, JPY, GBP, EUR and CHF) followed the growth of the financial cost in external markets (Chart 1.1.5).

Regarding domestic funding, the observed movements over the first half contribute to a perspective of greater funding stability. The share of demand deposits and other redeemable liabilities (Chart 1.1.6) – more subject to a bank run under crisis – kept its downward move in the first half of 2018. On the other hand, term deposits maturing over a year increased their share.

The extension of average maturities of the domestic funding allows financial institutions to maintain lower liquidity buffers to withstand stress scenarios. The slight decrease of 2% of the aggregate stock of liquid assets in the first half of 2018 supports that understanding. Furthermore, the Selic interest rate at the lowest level in Brazilian recent history raises the opportunity cost of keeping more liquidity than needed. Once the stocks of liquid assets are mainly Brazilian sovereign domestic bonds (TPFs), which yield falls along with Selic drop, that movement contributes to reduce liquidity levels.

Analyzing by type of ownership, in the same period, there was a decrease of 10% of liquid assets in private-owned banks, due to the gradual resumption of credit granting, mainly to natural person, and non-renewal of more expensive funding, partially offset by the decrease of reserve requirements for demand and saving deposits since May 2018. The public banks, in turn, increased their stock of liquid assets in 8%, due to less appetite to credit granting and easier access to low-cost funding than private-owned banks – which minimize the effects of yield decrease of the stock of TPFs held by them.

The banking system's aggregate short-term liquidity ratio (IL)⁶ closed the first half of 2018 at 2.13, 0.25 p. under the level of the previous semester (Chart 1.1.7) but still above the period before Brazilian economic recession initiated in 2014. Besides the minor drop of liquidity buffers, the increase of 9% in estimated outflows under stress scenarios contributed to the IL fall. The raise of

6/ The IL measures whether banks have enough liquid assets to cover their short-term (30 days) cash-flow needs in a simulated stress scenario, defined and calibrated by the BCB. Such cash outflows arises from the run-off of maturing or redeemable liabilities, losses from market risk exposures, for instance, margin calls and derivative pre-settlements, and other contractual outflows maturing in the next 30 days. Institutions with IL above 1 have enough liquid assets for such scenarios. For further calculation details, please refer to appendix Concepts and Methodologies, item a.

Chart 1.1.7 – Short-Term Liquidity Ratio – IL

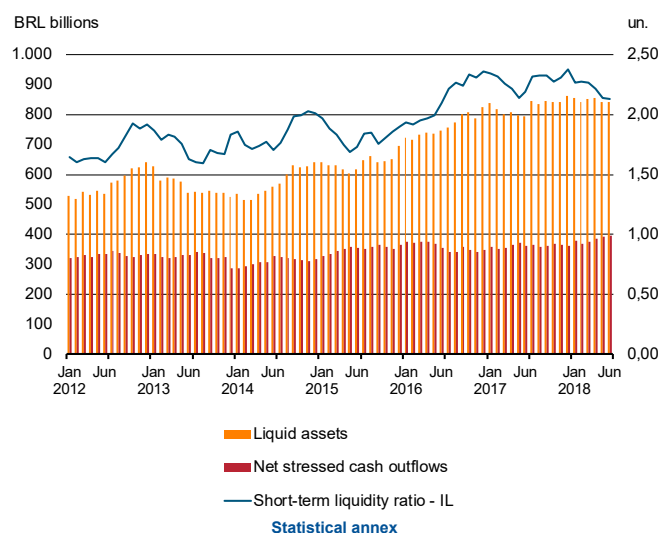


Chart 1.1.8 – IL Frequency Distribution^{1/}

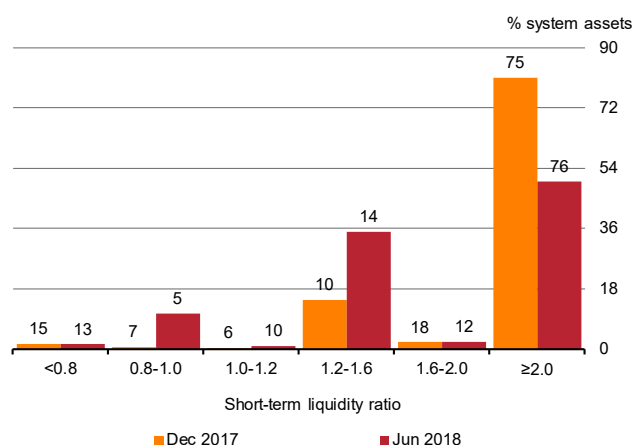
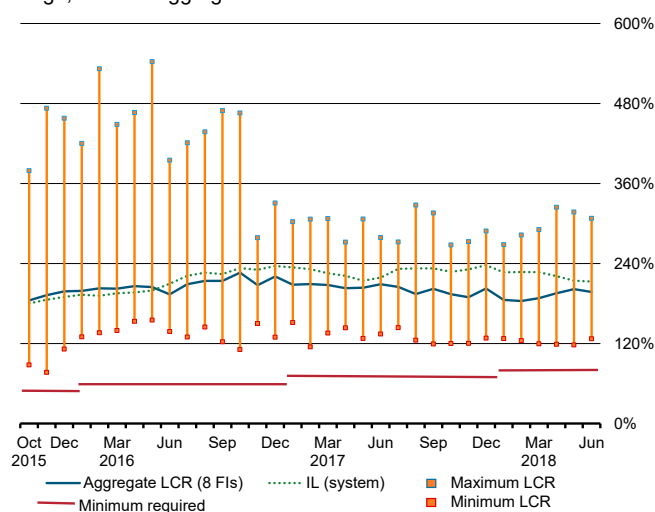


Chart 1.1.9 – LCR
High, low and aggregate



dollar and interest rate volatility led banks to increase their market positions subjected to daily settlements, arising from hedging strategies, raising the estimated outflows under stress scenarios.

Individually, the banking institutions maintained their short-term liquidity at comfortable levels, despite of, as aforementioned, private-owned banks had reduced their excess liquidity accumulated over recent periods (Chart 1.1.8). In June of 2018, 88.05% of the assets in the banking system were on balance sheets of banks with enough liquid assets to support a liquidity crisis ($IL \geq 1$). In comparison with the previous semester, the number of institutions with IL below 1 decreased from 22 to 18, with low representativeness in terms of total assets.

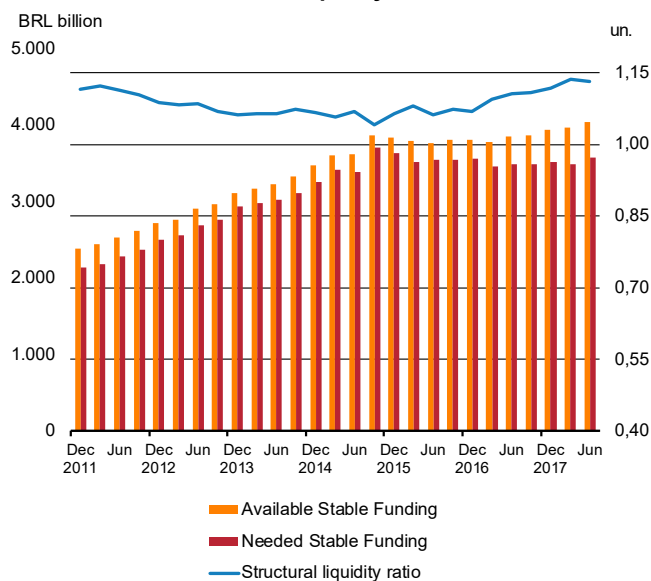
The Liquidity Coverage Ratio (LCR)⁷ corroborates the low liquidity risk already outlined by IL. All banking conglomerates required to comply with this ratio kept their ratios far above 100%, regulatory minimum to be required by 2019. The aggregate LCR of those institutions remained stable in June of 2018, reaching 197% (Chart.1.1.9). Thus, both the average LCR of the biggest institutions and the average IL of the baking system indicate a low short-term liquidity risk.

Regarding long-term liquidity risk, the funding structure of banks continues to indicate low susceptibility to liquidity crises in the long run. The aforementioned growth of long-term funding (maturing over a year) in the first half of 2018 reinforces the amount of stable funding and kept pace with the lengthening of the residual maturity of credit portfolio in the same period, in line with the pace of credit granting recovery. That movement led the Structural Liquidity Ratio (ILE)⁸ to remain stable at 1.13 in June 2018 (Chart 1.1.10) in comparison with the previous semester. The ILE is a measure of long-term liquidity risk assessment and it is based on Net Stable Funding Ratio (NSFR) methodology.

7/ In Brazil, all banks with total assets above BRL 100 billion must comply with the LCR (from October 2018 on, LCR will be required only for institutions considered in the S1 segment, under terms of art.2nd of Resolution n° 4,553, of January 30, 2017 and Resolution n° 4,616, of November 30, 2017. LCR requires that financial institutions maintain a stock of high quality liquid assets to withstand cash outflows for the next 30 days, under a standardized stress scenario set by the BCBS (www.bis.org/publ/bcbs238.htm). In 2018, the minimum requirement is 90% and will be 100% in January 2019. Domestic regulation set by Resolution n° 4,401, of February 27, 2015, and Circular n° 3,749, of March 5, 2015.

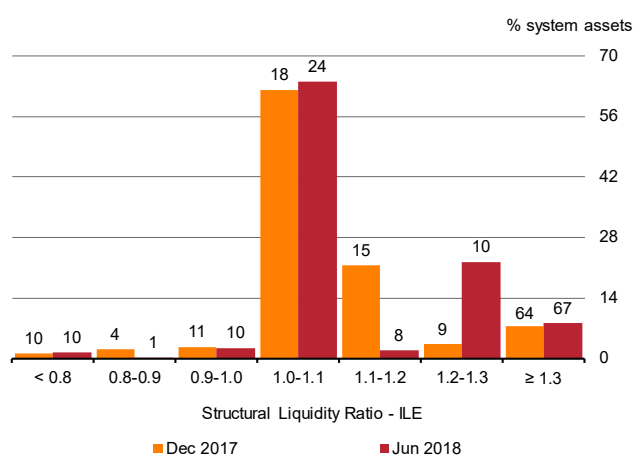
8/ ILE aims to measure whether banks have enough stable funding resources to finance their long-term activities. Thus, institutions with ILE equal to or greater than 1 are less susceptible to future liquidity problems. For details, see appendix Concepts and Methodologies, item b.

Chart 1.1.10 – Structural Liquidity Ratio – ILE



[Statistical annex](#)

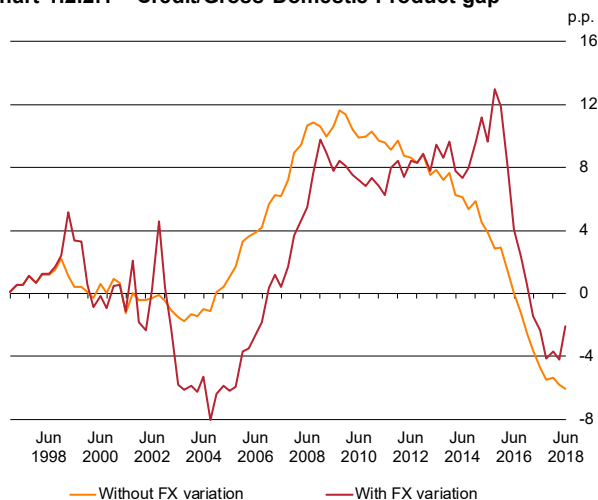
Chart 1.1.11 – ILE Frequency Distribution^{1/}



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

[Statistical annex](#)

Chart 1.2.2.1 – Credit/Gross Domestic Product gap



[Statistical annex](#)

The most representative banks in terms of assets (96.3% of banking system total assets in June 2018) maintained balance sheet structures that minimize long-term liquidity risk ($ILE > 1.00$). In comparison with the previous semester, the number of banks with ILE below 1 decreased from 25 to 21. Among these 21, only nine banks also have insufficient liquidity to withstand a crisis in the short term ($IL < 1$), representing 1.07% of banking system total assets.

Summing up, it is expected that the Brazilian banking system continue to face moments of little concerns about liquidity risk. Beyond the current funding structure, that contributes to minimize scenarios that could affect the financial stability, the current liquidity buffers are a comfortable source of protection against different stress events, still allowing the reallocation of resources to illiquid assets, such as credit, without raising relevant concerns. Furthermore, the prudential liquidity requirements designed after the financial crisis, LCR and NSFR^{9/}, will be limiting factors on excessive risk-taking.

1.2 Credit

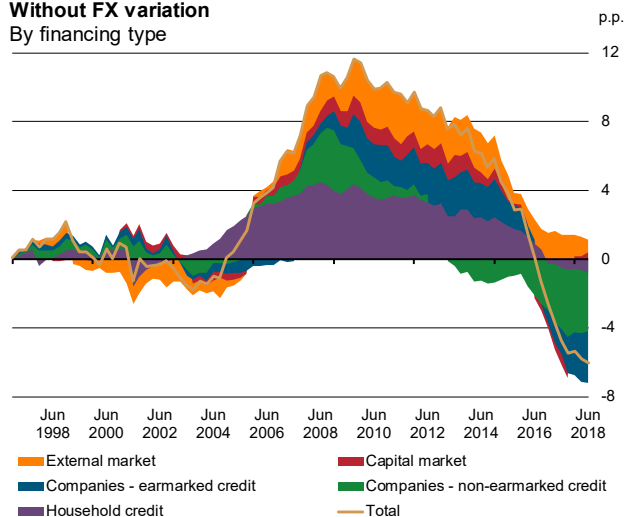
1.2.1. Introduction

Along with the liquidity risks of the banking system, credit risk indicators also improved in the first half of 2018. The macroeconomic environment had a positive impact – although small – in the recent expansion of companies and household funding. As pointed out in the Financial Stability Report (FSR) of April 2018, this movement remains especially among credit to individuals and private banks lending. Regarding companies, there is a recent increase in the debt issuance via capital markets for large companies, a decrease in the earmarked credit proportion, as well as a recent increase in non-earmarked credit to small and medium companies.

In the first half of 2018, the average interest rate of domestic bank lending fell from 25.6% p.y to 24.6% p.y.. The decrease was more expressive in credit to companies, from 16.8% p.y in December 2017 to 15.5% p.y in June of 2018 (relative to the household credit, the average annual interest rate fell from 31.9% p.y. in December 2017 to 31% p.y. in June 2018). On the other hand, the

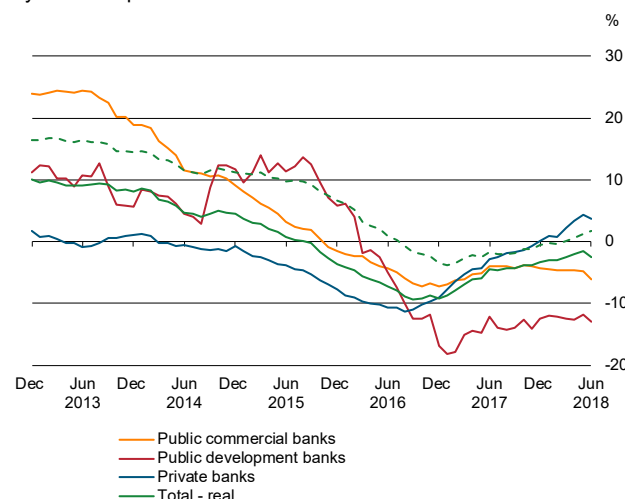
9/ The NSFR, set by Resolution CMN n° 4,616, of November 30, 2017, and methodology by Circular n° 3,869, of December 19, 2017, will take effect by October 2018.

Chart 1.2.2.2 – Credit/Gross Domestic Product – Without FX variation
By financing type



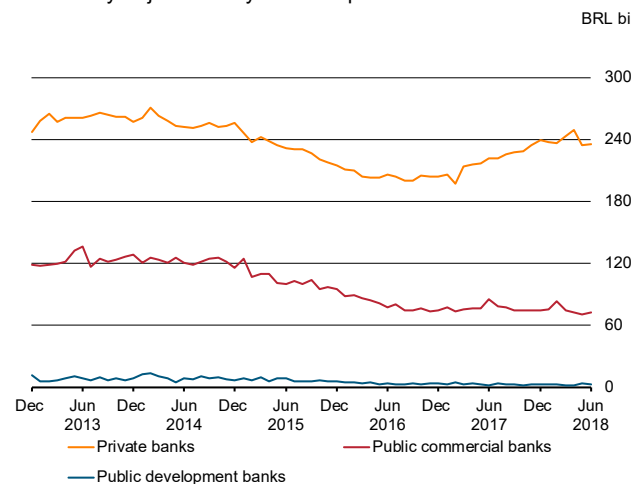
[Statistical annex](#)

Chart 1.2.3.1 – YoY real credit growth
By ownership



[Statistical annex](#)

Chart 1.2.3.2 – Real credit lending
Seasonally adjusted – By ownership



[Statistical annex](#)

total credit portfolio increased by 1.3% in the first half of 2018, result of a 2.7% increase in credit to households and 0.4% decrease in credit to companies.

The credit portfolio growth of the National Financial System (SFN) (still below its long-term trend) and the decreasing trend of problematic assets ratio (along with the stability in the coverage index) corroborated the perception that the SFN presents risks consistent with the business model adopted by financial institutions.

1.2.2. Broad credit and long run trend

The BCBS and the international literature¹⁰ consider the credit-to-GDP gap a good metric to assess whether the growth of the credit outstanding in a country is sound, or if it is above its long-term trend. This gap could signal an excessive increase in credit granted to companies and households, which could result in abrupt adjustments. Therefore, BCBS suggests that countries with the aforementioned gap above 2.0 p.p. should consider adopting measures to reduce credit growth.

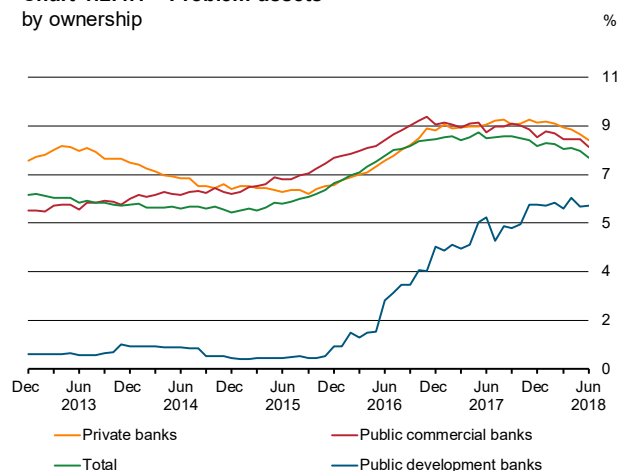
Currently the credit-to-GDP gap is negative at 6.05 p.p. of GDP, when the foreign exchange variation is disregarded (Chart 1.2.2.1). Albeit the credit granting improvement in the last semester, the gap trend is expected to remain negative in the short run: the main contributions come from the bank credit to companies, both earmarked and non-earmarked. The exceptions or, the positive contributions to the Gap, are the external market and, more recently, the capital market (Chart 1.2.2.2).

1.2.3 Domestic banking credit

The gradual recovery of the economy in the first half of 2018 made possible the slowdown of the downward trend in credit outstanding (Chart 1.2.3.1). The private banks had presented real credit growth, by increasing the credit concessions in 2018, (Graph 1.2.3.2). As the resumption was concentrated in private banks, the total domestic banking credit still demonstrated negative real variation during the semester.

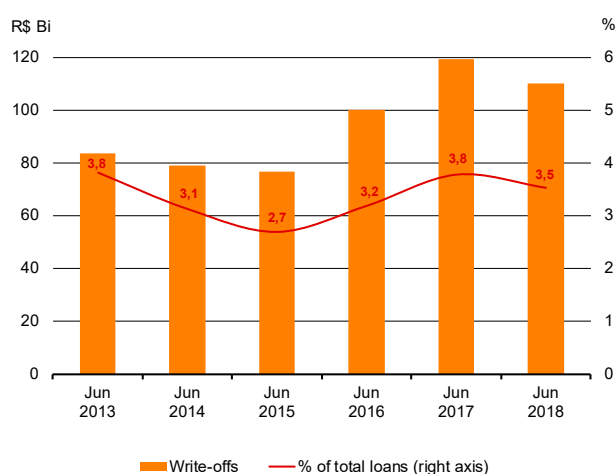
10/ Drehmann, M., Borio, C., and K. Tsatsaronis (2011): “Anchoring countercyclical capital buffers: the role of credit aggregates”, BIS Working Papers, no 355. Drehmann, M., and Juselius, M. (2011): “Evaluating early warning indicators of banking crises: Satisfying policy requirements”, BIS Working Papers, no 421.

Chart 1.2.4.1 – Problem assets by ownership



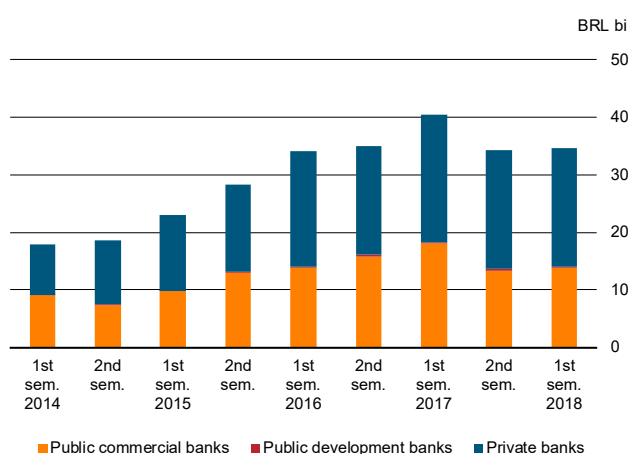
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Chart 1.2.4.2 – Write-offs



[Statistical annex](#)

Chart 1.2.4.3 – Restructured debt flow accumulated in the semester



[Statistical annex](#)

The growth of the domestic credit portfolio in the next months should still be granted by private banks, especially in the credit for individuals.

1.2.4. Risks and provisioning

The main credit risk indicators reflected the gradual recovery of the economy in the first half of 2018, by presenting a continuous improvement of the loan portfolio quality. The problem assets loans reduced significantly in the first half (0.42 p.p.), mainly of commercial public and private banks. This significant decline was explained by the low risk appetite of both segments in recent years. Regarding public development banks, the trend of problem assets portfolio has finally stabilized, after two years of strong growth, although still at a high level (Chart 1.2.4.1).

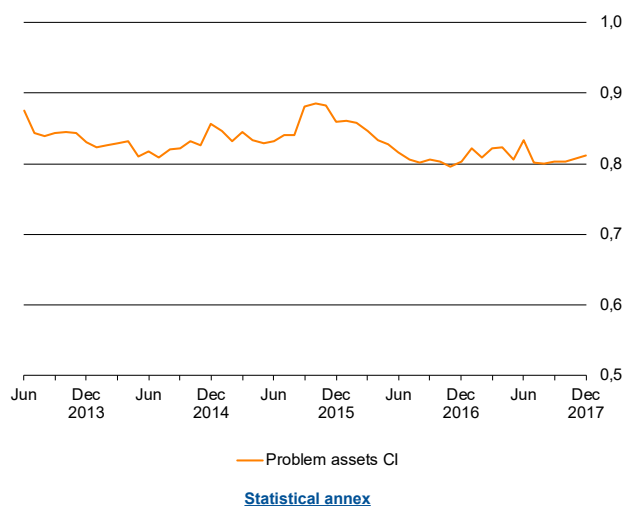
The amount of write-offs has also evidenced the improvement of the bank loan portfolio (Graph 1.2.4.2). The write offs decreased in relation to the previous half, confirming that the cycle of loss materialization in banking portfolio is getting to an end. The declining movement of write-offs was more pronounced in corporate loan portfolio, since the credit for individuals has already returned to its poise. It is expected that write-offs would contribute less to the reduction in the problem assets in the coming semester.

Although the current level of restructured loans has remained close to the previous six-month period, this amount decreased 14% in comparison to the first half of 2017. The data indicates a lower necessity for banks to negotiate payment conditions of borrowers' in financial difficulty (Chart 1.2.4.3).

Maintaining the current economic scenario, the downward trend of the problematic assets should lose strength in the next semester, as the problem assets of household portfolio has already returned to pre-crisis level. Only the improvement of the corporate loans, mainly in large companies, would prolong the downward trend of total problem assets.

The coverage index of problem assets still remained above 80% in the first half. The indicator maintained stabilized, despite the reduction of banks provisions to support losses in their loan portfolio. The reduction of provisions occurred due to the improvement signs of the loan quality which indicates that the financial system has

Chart 1.2.4.4 – Coverage index (CI)



maintained a provisioning level according to profile of the risk of their credit assets (Chart 1.2.4.4).

The decrease of credit risk indicators, particularly the problem asset, shows that the quality of the domestic bank loan portfolio improved in the first half, both in private and in commercial public banks. This enhancement in asset quality, combined with the maintenance of satisfactory levels of provisioning for assets considered problematic, indicates a lower risk to financial stability in the domestic bank loan portfolio.

1.2.5. Companies

Despite the improvement in the country's macroeconomic conditions in 2018, the business environment for the Brazilian non-financial corporations remains uncertain. On the one hand, there is evidence of improvement, with the recovery in cash generation and the increase in company's profitability, on the other, the payment capacity remained stable (Chart 1.2.5.1), the amount of requests for judicial recovery remained above of the previous years (Chart 1.2.5.2), the Real depreciated sharply and investments have not yet recovered.¹¹ After two years of activity decline and several negative demand shocks – 2017 and especially 2018 – the already mentioned economic improvements together with the restructurings carried out during this period indicate that the risks to financial stability arising from non-financial corporations are declining.

Chart 1.2.5.1 – Interest coverage ratio (median)
Numerator and denominator (deflat.): Dec/2011=100

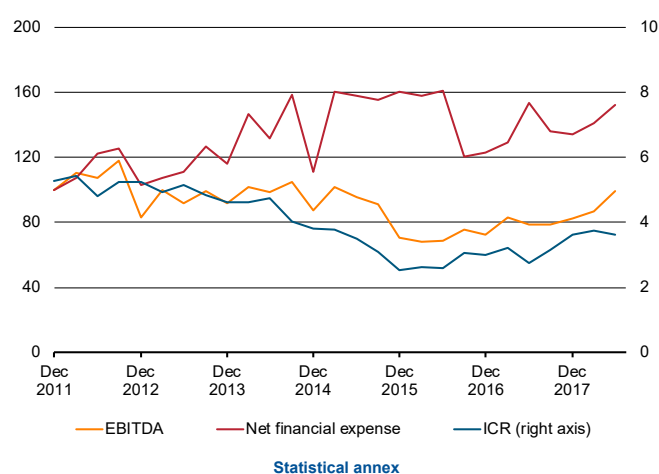
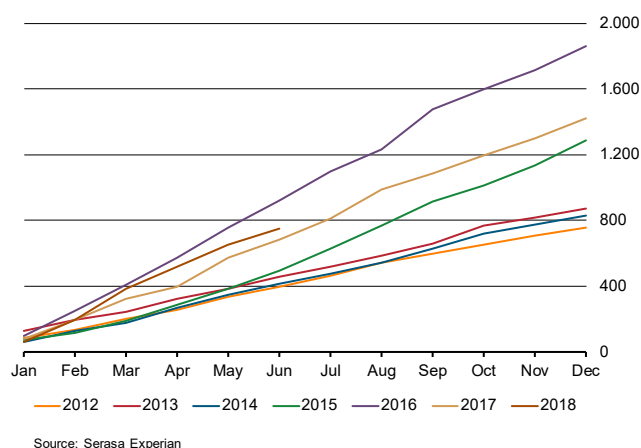


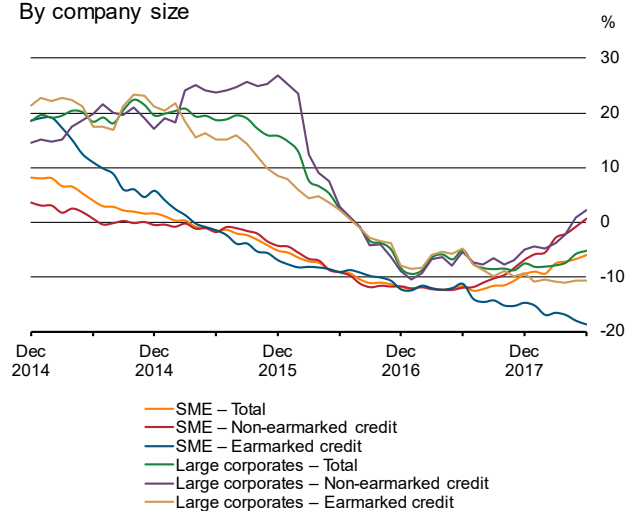
Chart 1.2.5.2 – Corporations in judicial recovery
Cumulative requests by year



Notwithstanding the prospective uncertainties regarding a more consistent recovery of the economy, the credit market for the Brazilian companies registered some signs of improvement. Regarding domestic bank credit, the volume of corporates financing is still lower than that recorded twelve months earlier. However, this contraction movement in funding by financial institutions focuses on earmarked loans, since non-earmarked credit for small and medium enterprises (SME) has already a positive growth (Chart 1.2.5.3). For large companies, the stock of non-earmarked loans increased 2.3%, influenced by the appreciation of the US dollar in the period. Discounting the exchange rate effect, the portfolio stock would have fallen -0.4%. Although negative, the variation is lower compared to that observed in the previous semesters.

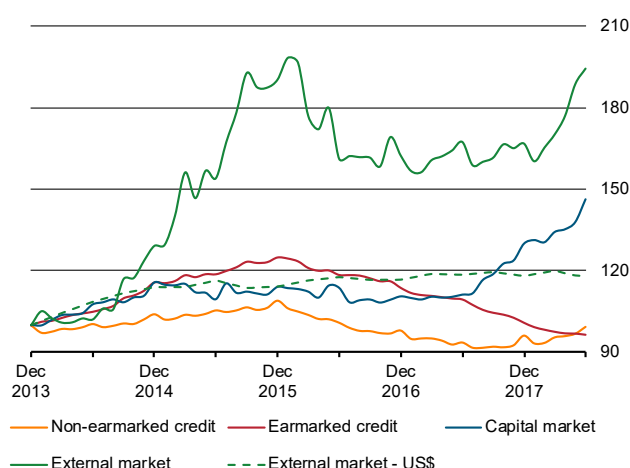
11/ According to IBGE, the investment rate in the first quarter of 2018 was 16% of the GDP – above the one observed in the same period of the previous year. Despite the improvement, this is the second lowest rate for the first quarter since 1996.

Chart 1.2.5.3 – YoY credit growth
By company size



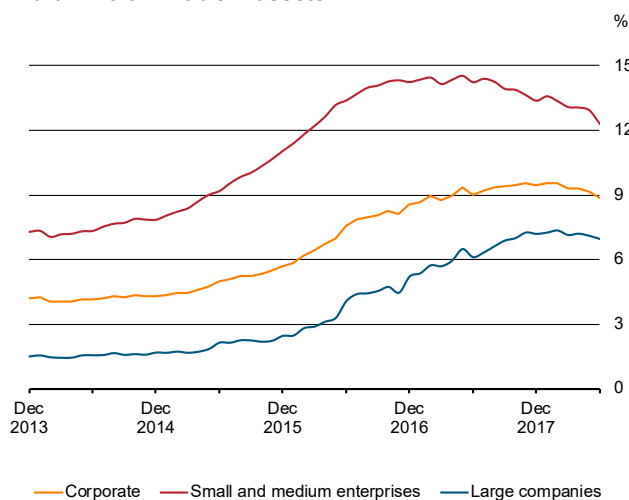
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Chart 1.2.5.4 – Corporate indebtedness
Dec/2013 = 100



[Statistical annex](#)

Chart 1.2.5.5 - Problem assets



[Statistical annex](#)

The external debt, after significant growth between 2010 and 2015, has remained stable since 2016 when measured in US dollars (Chart 1.2.5.4). Such a movement demonstrates that despite the recent increase in the interest rates in advanced economies and the appreciation of the currencies of these countries, there is no scarcity of resources to Brazilian non-financial corporations in the international market.

The capital market continued to register significant growth in 2018, having varied BRL 39.2 billion, or 12.6% in the semester. Such a change in the financing structure has not been uniform, being concentrated in a few companies and in specific sectors such as “Petrochemical”, “Energy” and “Services”.¹²

For the next few months, the trend is to maintain this scenario: recovery of non-earmarked credit, especially in the most profitable and less risky modalities, and search for alternative sources of financing among companies with access to capital and external markets.

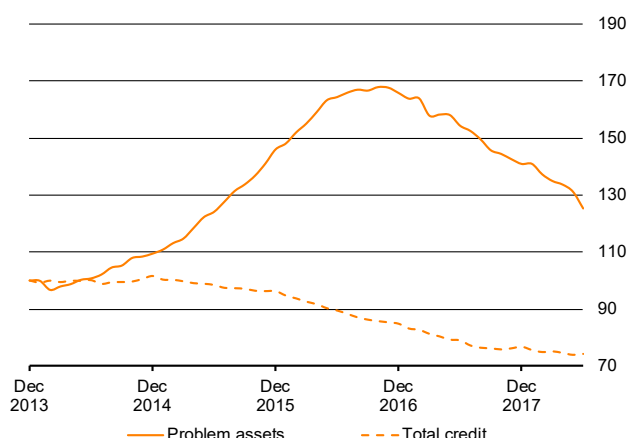
Signs of improvement are also observed in risk indicators. Unlike previous periods, in the first half of 2018 the share of problem assets fell not only to SMEs but also to large companies (Chart 1.2.5.5). Among SMEs, where the main source of financing is domestic bank credit, the decrease was higher (1.08 p.p. in the first half of 2018 and 1.94 in the 12-month period), with the stock of problem assets decreasing in higher proportion than the outstanding portfolio (Chart 1.2.5.6).

Among large companies, the indicator already shows a slight improvement in the semester (-0.24 p.p.). It should be noted that the fall in the problem assets occurred due to the default rate decrease (Chart 1.2.5.7), since restructuring and “E to H” rated performing loans remained stable.

Summing up, although the uncertain perspectives to companies, there are signs of improvement in the corporate credit market, especially SMEs. The credit’s stock growth, albeit still negative, shows rebound evidence on the declining trend that began two and a half years earlier. There are strong evidences that the risk materialization cycle to SME has ended, but will probably last for large companies, once i) problem assets are still high and ii) the financial indicators of public-listed companies are still worse than the ones of pre-crisis period. Nevertheless, the risk to financial stability due to

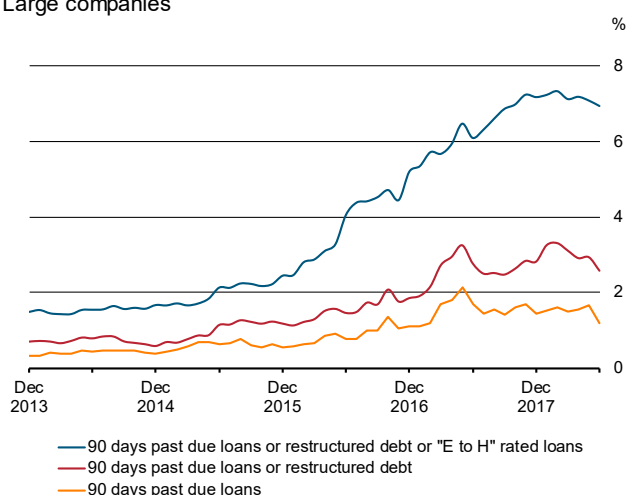
12/ For more details about the growth of the capital market, see Section 2.2.

Chart 1.2.5.6 – Problem assets
Small and medium enterprises (Dec/2013 = 100)



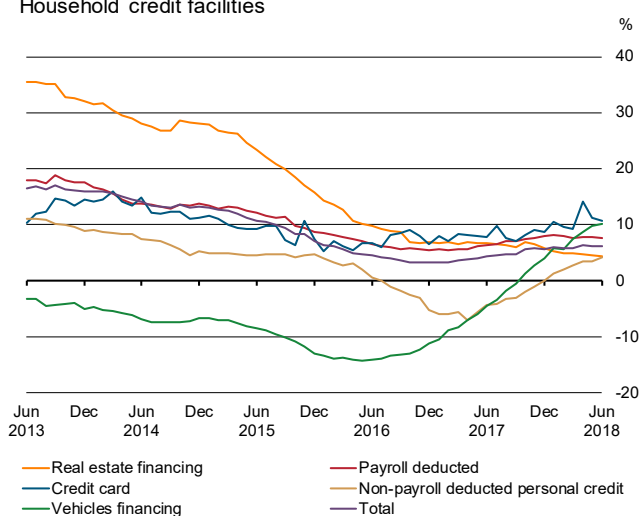
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Chart 1.2.5.7 – Problem assets
Large companies



[Statistical annex](#)

Chart 1.2.6.1 – YoY credit growth
Household credit facilities



[Statistical annex](#)

non-financial companies' debts has decreased in the first half of 2018.

1.2.6. Households

Bank credit for individuals maintains the recovery trend started in 2017, with increased credit lending and portfolio quality improvement. The resumption of the household credit portfolio growth follows, so far, without indication of an increase in the credit risk incurred by financial institutions. Once again, the highlight is the vehicles financing portfolio, which currently increases at an annual rate of 10.1%, after several years of retraction (Chart 1.2.6.1).

The loan granting maintained the level throughout the first semester of 2018, which signals an improvement compared to 2015 and 2016, with exception being real estate (Chart 1.2.6.2). The vehicles financing¹³ accompanied the resumption of automobile sales¹⁴, however without relevant increases in delinquency cohort in relation to the last years and significantly lower than the historical figures (Chart 1.2.6.3).¹⁵

Economic growth in 2018, even at a moderate pace, contributed to the resumption of credit to individuals. Reduction of unemployment¹⁶ and improvement in household income¹⁷, allied to falling inflation and interest rates have contributed to the decrease in the household indebtedness¹⁸ and debt service to income¹⁹ throughout the last years (in spite of the increases in the first half of 2018). The most impacted were the credit facilities linked to consumption such as vehicles financing, payroll deducted and credit card (Charts 1.2.6.1 e 1.2.6.2).

Regarding credit card, due to the economic improvement, there was an increase in “credit card purchase”, “payback

13/ The increase occurred in April 2018 of the seasonally adjusted vehicle financing for household series was not verified on the nominal data.

14/ Indeed, average sales in the first half of 2018 increased to 234 thousand vehicles, from 214 thousands in the same period of 2017 and 180 thousand in 2016. BCB Time Series no. 1,378 – Vehicle sales (total). Source: Associação Nacional dos Fabricantes de Veículos Automotores (Anfavea).

15/ Delinquency cohort in this report is the percentage of the total credit granted in a particular date that was 90 days past due after 6 months. For delinquency cohort, see <<https://www.bcb.gov.br/pt-br/#!/p/txinadimplencia>>.

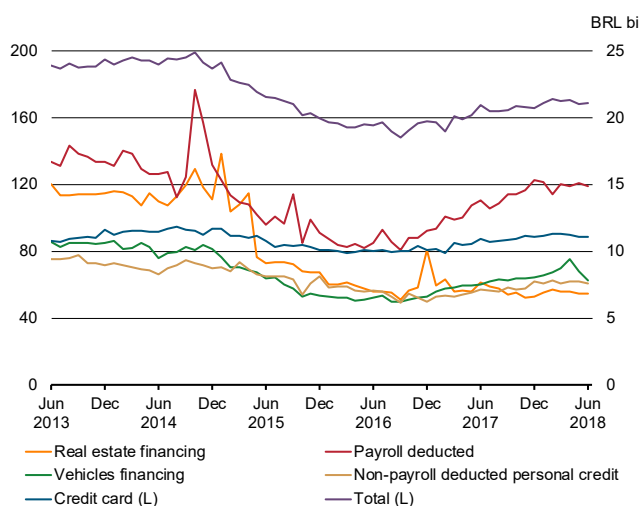
16/ BCB Time Series no. 24,369 – Unemployment rate – PNADC.

17/ BCB Time Series no. 24,382 – Real habitually average earnings of employed people – Continuous PNAD

18/ BCB Time Series no. 19,882 – Ratio of total household banking debt to disposable income accumulated over the past 12-m

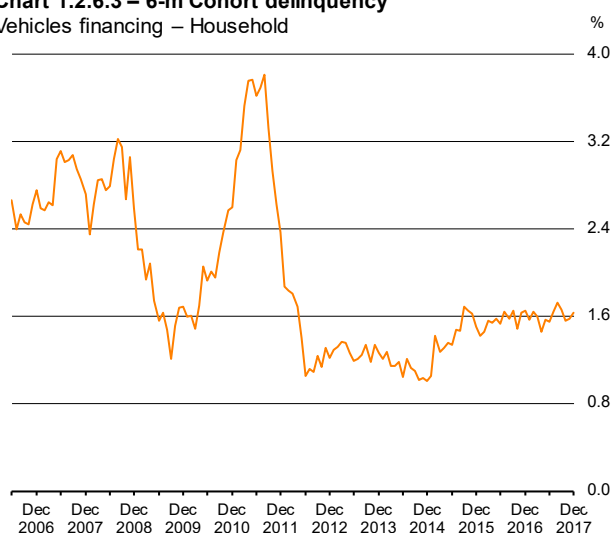
19/ BCB Time Series no. 19,881 – Household debt service ratio – Seasonally adjusted data.

Chart 1.2.6.2 – Real credit lending to households
Seasonally adjusted



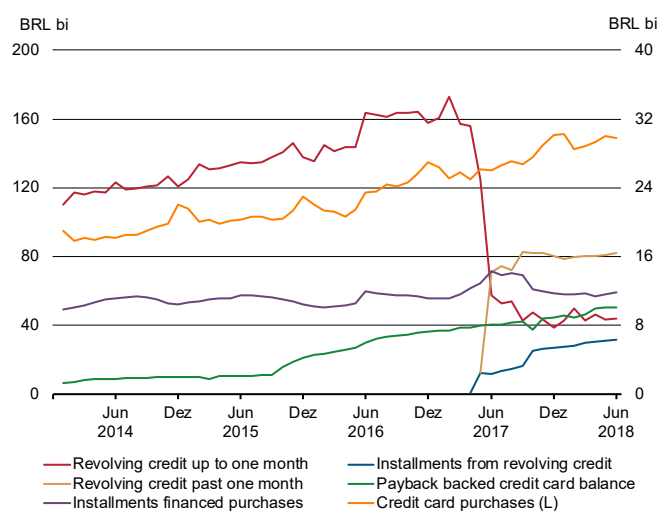
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Chart 1.2.6.3 – 6-m Cohort delinquency
Vehicles financing – Household



[Statistical annex](#)

Chart 1.2.6.4 – Credit card by modalities



[Statistical annex](#)

guaranteed card balance”, “installments from revolving credit”²⁰ (Chart 1.2.6.4).²¹ On the one hand, “credit card purchase” has come along with the household consumption recovery, on the other, the increase outstanding of “payback guaranteed card balance” is a result of the more intense offer of this product by some financial institutions. Finally, the increase of “installments from revolving credit” is also due to the normative change of Jan/2017²². This change in regulation allowed that an advantageous offer could be made to the debtors that have financed invoices by means of a revolving credit after the subsequent invoice payment day²³.

Other result of the normative change in credit cards is the increase of the invoice average payment (Chart 1.2.6.5)²⁴. After a period of adaptation by the financial institutions and customers, the invoice average payment observed was superior than the one before the prohibition of outstanding revolving credit in terms superior to thirty days.²⁵

Under the perspective of risk analysis, the problematic assets decreased or were maintained for all household credit facilities in the first semester of 2018 (Chart 1.2.6.6). Credit portfolio for individuals improved not only in the risk levels, but also in granting especially of more consumer-related modalities. Given the continuity of the economic environment improvement, the recovery of the credit to individuals is expected to remain throughout the second half of 2018.

20/ The credit facility “installments from revolving credit” shows the outstanding of the revolving credit operations that were divided in installments in better conditions to the debtor.

21/ The information presented in this section regarding credit cards may differ from other BCB publications, once the credit card facilities are classified differently.

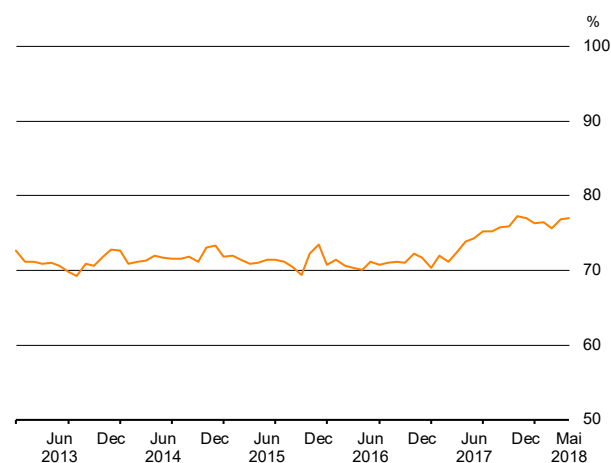
22/ According to Resolution nº 4,549, of January 26, 2017.

23/ The reduction of credit cards indebtedness is part of the BC+ Agenda, which aims to reduce household leverage, contributing to the improvement of financial stability.

24/ Data from the Credit Bureau of this Central Bank was used to calculate a proxy of the credit card invoice. Firstly, it is estimated the invoice to be paid in the subsequent month, per individual: this is done through the Credit Bureau information of the payment due within 30 days, as well as revolving and overdue credits (which enter in full on the monthly invoice). Then it is calculated how much of the invoice was not paid, measured from the increased amount in the revolving balances or invoice installments. The difference between these two figures is considered as the amount that was actually paid from the monthly invoice.

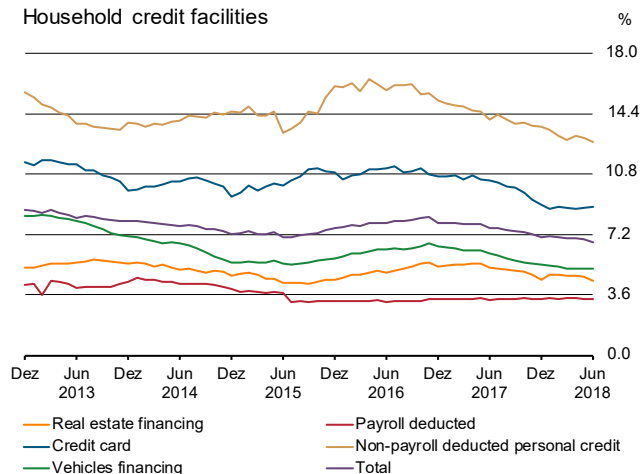
25/ Consistent with the information presented here, Panorama magazine (Abecs) does a survey with credit card users. In 2017, this survey revealed that “among 10 credit card users, only 1 uses revolving credit.” In 2018, that “among 100 credit card users, only 5 use the revolving credit.” Available at: <<https://www.abecs.org.br/revista-abecs>>.

Chart 1.2.6.5 – Credit card balance - average payment



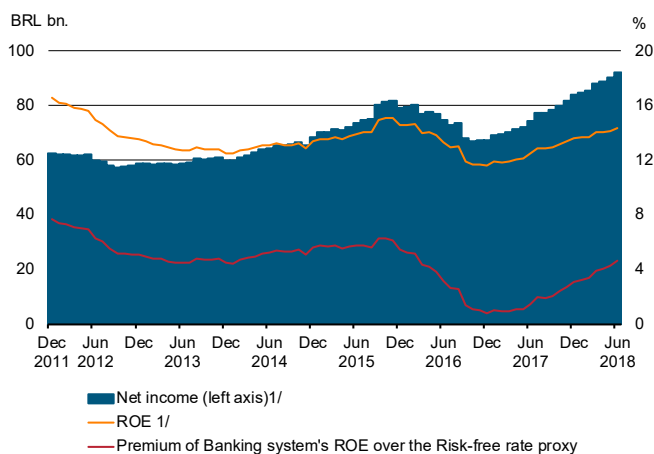
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Chart 1.2.6.6 – Problem assets
Household credit facilities



[Statistical annex](#)

Chart 1.3.1 – Return on equity (ROE)^{1/}
Trailing twelve months



^{1/} Excludes non-recurring income.

[Statistical annex](#)

1.2.7. Conclusions – Credit

The economic environment had a positive impact – even if timid – in the recent evolution of the individuals and corporate financing. The reduction of risks indicators and increase of credit granting are the positive highlights, especially for individuals and by private banks. The recent increase of non-earmarked credit to small and medium companies and of the capital market for corporations show creditors appetite for non-financial Brazilian corporations starts to sign the recovery.

Summing up, the level of growth of the SFN's credit portfolio (still below its long-term trend) and the decreasing trend of problematic assets (followed by relatively a stabilized coverage index) corroborate the perception that the SFN displays risks consistent with the business model adopted by its institutions.

1.3 Profitability

Banking system profitability continued to rise in the first half of 2018. Return on Equity (ROE)²⁶ reached 14.3% in June, an increase of 0.7²⁷ p.p. compared to December 2017 (Chart 1.3.1). This improvement is also evidenced when ROE is compared to the risk-free rate proxy²⁸. Contraction in loan loss provisions (LLP), operational efficiency gains, as well as the gradual decrease in credit rates coupled with a more timely reduction in funding costs were the main drivers for the profitability increase.

Net interest margin²⁹ remained stable throughout the first half of the year. Net credit margin showed a slight increase influenced by a more timely reduction in funding costs when compared to the credit income³⁰. Another factor that improved the net credit margin was the change in the loan portfolio mix, with loan to households increasing its importance, a line that usually presents pre-fixed profile and higher rates. Concerning

^{26/} The adjustment is intended to disregard relevant non-recurring values in the profit analysis.

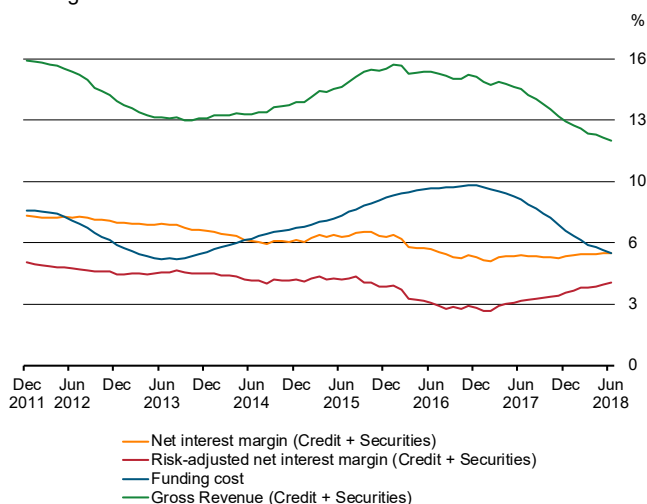
^{27/} The disclosed ROE in the last Financial Stability Report (December 2017) was revised due to correction and restatement of accounting reports, resulting in a reduction of the Banking system's ROE from 13.8% to 13.6% in the respective date.

^{28/} The risk-free rate proxy in this report is defined by the average Selic annual rate over the last 36 months multiplied by 0.85 to take into account the tax effect. The 36-month period was based on the weighted average maturity of the loan portfolio, the main source of banking revenue.

^{29/} In this report, net interest margin represents the difference between the return on the loan and securities portfolio and the cost of funding.

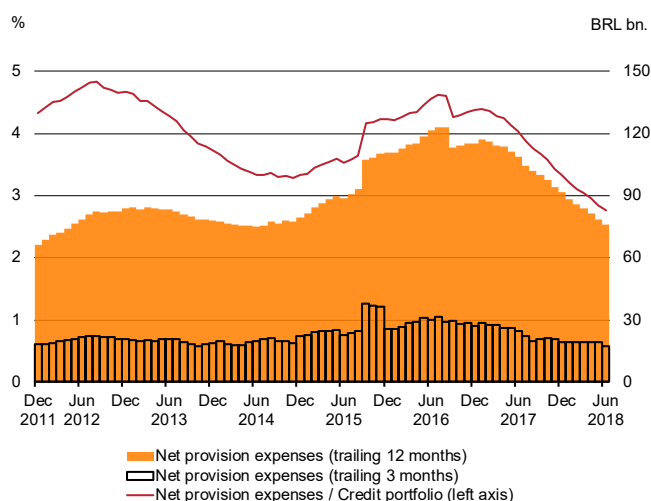
^{30/} Banks funding interest rate in Brazil is predominantly post-fixed while loan's portfolio interest rate is predominantly pre-fixed.

Chart 1.3.2 – Net interest margin
Trailing twelve months



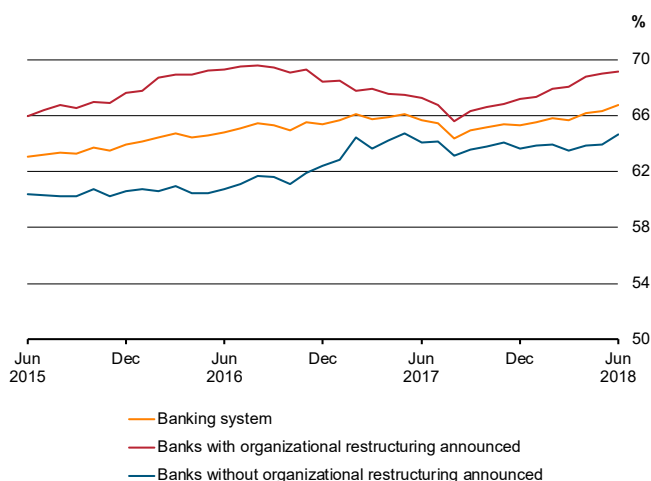
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Chart 1.3.3 – Provision expenses



[Statistical annex](#)

Chart 1.3.4 – Coverage ratio of administrative expenses
Trailing twelve months



[Statistical annex](#)

securities portfolio, net interest margin stabilized in the last semester, after the downward path, following the Selic rate trend (Chart 1.3.2).

Risk-adjusted net interest margin maintained an upward movement throughout the semester, mainly due to LLP reduction. This is the most relevant factor to explain the increase in net income over the last period. However, quarterly LLP has shown a trend towards stabilization, which should be reflected in the twelve months LLP over the following periods (Chart 1.3.3).

Services income has kept growing, driven by significant rise in bank account fee and payment card fee, complemented by investment fund services fees³¹. The coverage ratio – operational expenses divided by services income – was mainly impacted by staff reduction and branches shutdown. Although organizational restructurings³² initially generated extraordinary expenses, they have recently contributed to a lower increase in operational expenses compared to services income evolution (Chart 1.3.4)³³. While operational expenses (trailing 12 months) grew 2.1% from December 2017 to June 2018, below the accumulated inflation over the period (2.6%)³⁴, revenues from services increased 4.3%, reinforcing the trend towards improvements in banking operational efficiency, whose positive effects should contribute to banking system profitability until the end of the year (Chart 1.3.5).

Improvement in the share and in the number of banks with profitability above the risk-free rate proxy has confirmed that the recovery in profitability was widespread in the banking system, including the smaller institutions, which were the most affected by the economic downturn. (Chart 1.3.6). Despite this, small banks that heavily rely on securities portfolio and/or on corporate credit consumers have faced greater challenges to recover their profitability at pre-crisis levels.

“Corporate Credit³⁵” banks operate in a market that was deeply affected by the economic crisis. Relevant

31/ The increase in investment funds administration fees has been mainly due to the expansion in the investment funds portfolio in recent periods. Additional information about investment funds can be found in Section 2.1 of this report.

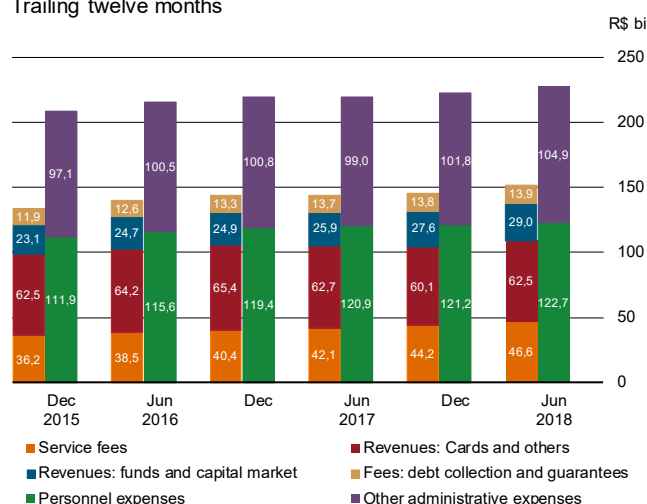
32/ Voluntary Dismissal Programs and/or shutdown of branches plans announced in the public media.

33/ At the beginning of the second half of 2017, the coverage ratio series evidenced a one-off reduction movement, due to the “Tax Regularization Program”, which resulted in unusual administrative expenses.

34/ Inflation measured by the Broad Consumer Price Index (IPCA) in Brazil.

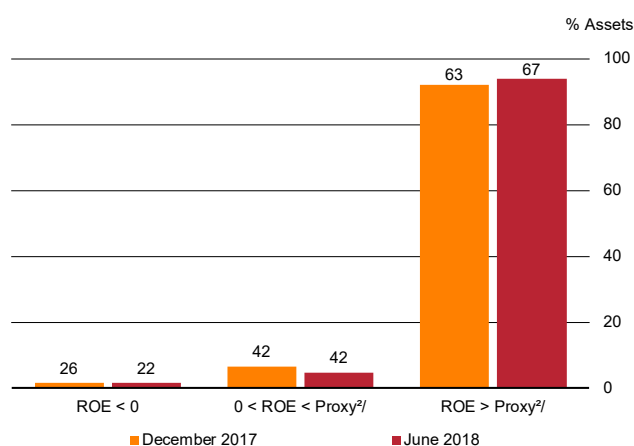
35/ The “Corporate Credit” segment is comprised by banks that mainly intermediate loans and focus on corporate consumers (corporate = balance contracts > R\$ 1 million).

Chart 1.3.5 – Main components of administrative expenses and services income
Trailing twelve months



[Statistical annex](#)

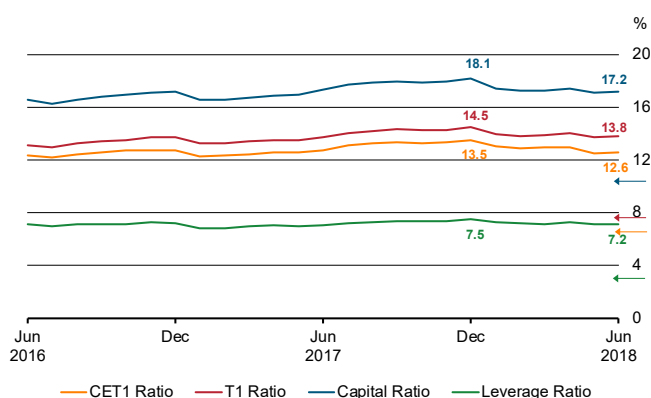
Chart 1.3.6 – Return on equity (ROE) frequency distribution^{1/}



1/ Values above the bars represent the number of financial institutions in the correspondent ROE range.
2/ Risk-free rate proxy.

[Statistical annex](#)

Chart 1.4.1 – Capital ratios and regulatory requirements¹



1/ The arrows represent the regulatory requirements for different capital levels, including Conservation Buffer (6.375% for CET1 Capital, 7.875% for T1 Capital, 10.5% for Total Capital and 3.0% for Leverage ratio). The leverage ratio data considers only Commercial, Multiple, Foreign Exchange, Investment and Saving banks classified as S1 or S2, according to the Resolution CMN no 4,615/17.

[Statistical annex](#)

delinquency was observed in large non-financial companies and banks that were more exposed to these customers have suffered significant losses due to the high levels of troubled assets. Additionally, the tendency of better credit quality customers looking for financial resources outside the banking market³⁶ has affected these banks business model. Profitability of banks operating in the “Treasury and Investments³⁷” segment has been strongly influenced by the Selic rate reduction, which directly affects their net interest margin. In general, banks with diverse income streams have better performed over the adverse period.

Profitability growth in the first half of the year was driven mainly by better asset quality and reduction in LLP, a consequence of the improvement in the economic environment, and by operational efficiency gains. However, the current cycle of LLP reduction, the lower interest margins in the securities portfolio and the gradual decline in credit rates over the coming periods tend to slowdown the upward trend profits. On the other hand, the change in the credit portfolio mix, mainly due to a faster expansion in the household’s portfolio, and the gradual recovery in credit growth as a whole bring positive impacts to the net interest income. Therefore, the outlook is a slowdown in the upward path of the banking system profitability over the next semester, although conditions remain relatively favorable for profitability increase.

1.4 Solvency

The banking system solvency remain at a high level, although with a slight decrease in the first half of 2018. The capital and leverage ratios continue significantly above the regulatory requirements (Chart 1.4.1), revealing the soundness of the system’s solvency, even considering both the fully-fledged Basel III framework and the leverage ratio minimum requirement³⁸ (3.0%), effective since January 1st, 2018.

The banking system’s Common Equity Tier 1 ratio (CET1) reached 12.6%, with a minor reduction, reflecting the resumption of the risk-weighted assets (RWA) growth

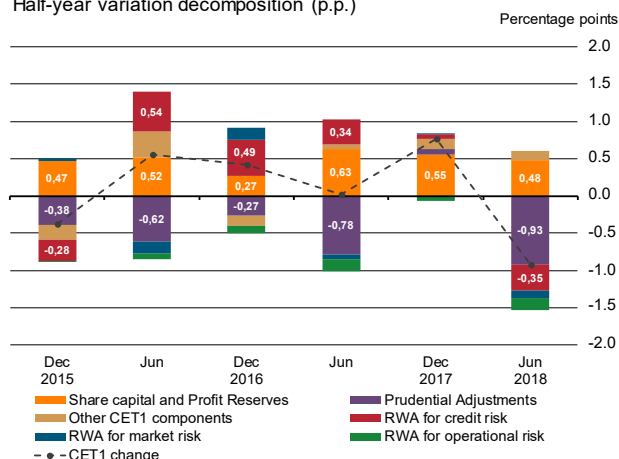
36/ See Section 2.2 of this report for further details.

37/ The segment “Treasury and investment activities” is composed by banking conglomerates with greater dependence on treasury and business operations (bonds, repurchase agreements and investments) in the generation of their income.

38/ The leverage ratio minimum requirement of 3.0% was established by the Resolution CMN n° 4,615, of November 30th, 2017, applicable for institutions classified as S1 or S2, accordingly to the Resolution CMN no 4,553, of January 1st, 2017.

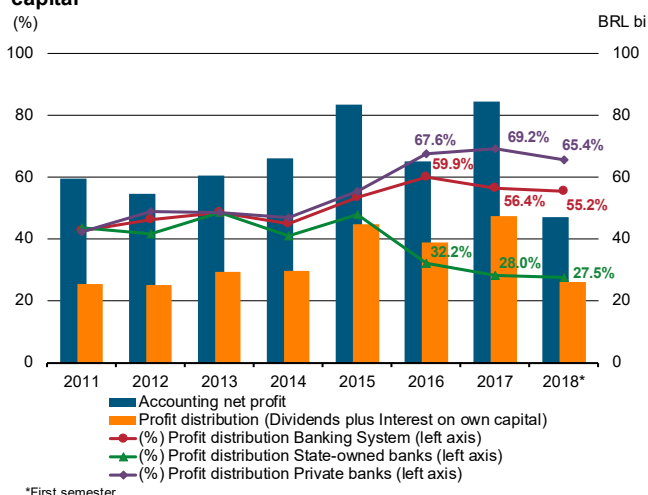
Chart 1.4.2 – CET1 variation dynamics

Half-year variation decomposition (p.p.)



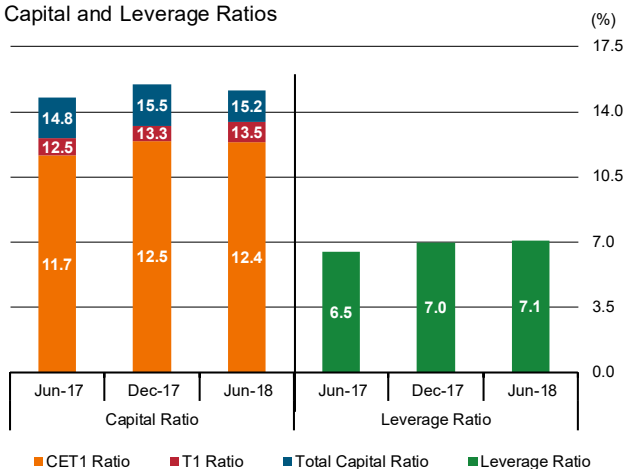
[Statistical annex](#)

Chart 1.4.3 – Dividends and Interest on own capital



[Statistical annex](#)

Chart 1.4.4 – Fully-fledged Basel III Capital and Leverage Ratios



* Fully-fledged Basel III simulation considers the phase-out factor of debt capital instruments, according to the Resolution CMN nº 4,192/13 and nº 4,679/18. The leverage ratio data considers only Commercial, Multiple, Foreign Exchange, Investment and Saving banks classified as S1 or S2, according to the Resolution CMN nº 4,615/17.

[Statistical annex](#)

and an increase in prudential adjustments, mainly due to the fully-fledged Basel III prudential adjustments timetable³⁹ and to the growth of DTA arising from tax losses. On the other side, an increase in profits, as consequence of a reduction in loan loss provisions and an improvement in operational efficiency, favorably contributed to the capital base.

The dividend distribution level (Chart 1.4.3), associated with new issuances of debt capital instruments, points to a capital structure optimization. Private banks maintained a higher profit distribution, when comparing with previous periods, while state-owned banks increased the retained earnings, strengthening their capital structure.

The system's risk weight assets⁴⁰ increased by 4.6%⁴¹, reflecting RWA's growth in private banks (6.6%) and, to a lesser extent, in state-owned banks (0.9%). Considering only the RWA for credit risk, private banks continued expanding their lending portfolio, while state-owned banks maintained a contraction trend in the credit volume. It is worth mentioning that between June 2015 and December 2017 the RWA evolution positively contributed to the capital ratios dynamics, due to the deleveraging process during the economic downturn period. From the first half of 2018 on, the RWA inverted its tendency, in line with the growth of credit and assets.

The fully-fledged Basel III framework simulation, including the phase-out factor of debt capital instruments⁴², shows that the system's capital and leverage ratios would remain in a comfortable level (Chart 1.4.4), reflecting the soundness of the system's solvency. The projected CET1

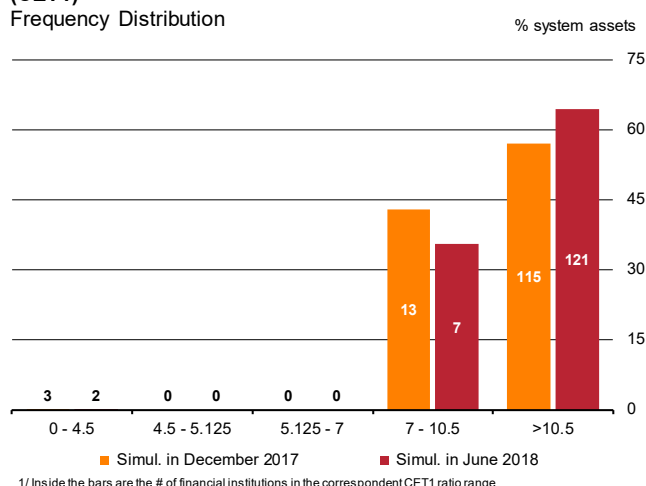
39/ According to the art. 11 of the Resolution CMN nº 4,192, of March 1st, 2013, the factor applied to prudential adjustments went from 80% to 100% from January 1st, 2018 on. Also, in accordance with art. 28, the phase-out factor for debt capital instruments issued before Basel III took place evolved from 50% to 40%.

40/ RWA for credit, market and operational risk, with the latter two being affected by the progress of Basel III timetable schedule, with F factor reducing from 9.25% to 8.625%, from January 1st, 2018 on, according to the art. 4 of the Resolution CMN nº 4,193, of March 1st, 2013.

41/ The Circular BCB nº 3,849, of September 18th, 2017, which is effective from January 1st, 2018 on, established, among other measures, new treatments to capital requirements for exposures to qualifying central counterparties (QCCP). These changes have not produced material impact on the banking system's exposure.

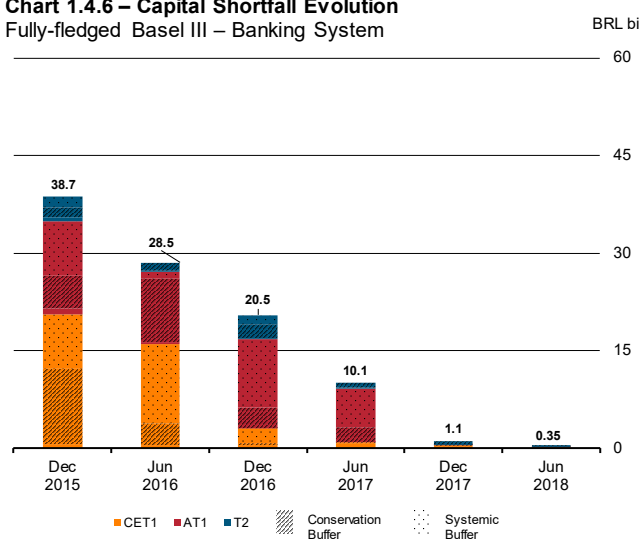
42/ From this Financial Stability Report edition on, the fully-fledged Basel III simulation considers the phase-out factor of debt capital instruments until 2022, according to articles 27 to 29 of the Resolution CMN nº 4,192, of March 1st, 2013. Moreover, now the methodology considers, until that same year, a specific phase-out factor timetable for debt capital instruments related to Constitutional Funds, according to Resolution CMN nº 4,679, of July 31, 2018. These changes impact projected Tier 1 and Total Capital ratios. Prior to this Financial Stability Report edition, the fully-fledged Basel III simulation effects were estimated up to 2019, aligned with the end of the timetable schedule of minimum capital requirements.

Chart 1.4.5 – Fully-fledged Basel III - Common Equity Tier I (CET1)¹
Frequency Distribution



[Statistical annex](#)

Chart 1.4.6 – Capital Shortfall Evolution
Fully-fledged Basel III – Banking System



[Statistical annex](#)

ratio histogram reveals that 128 institutions, accountable for 99.9% of the system's total assets, reported ratios above 7.0%, which will be the minimum requirement for 2019 on (Chart 1.4.5). The projected capital shortfall, considering the fully-fledged Basel III framework, presented a reduction from BRL 1.1 in December 2017 to BRL 0.35 billion in June 2018 (0.05% of the current system's total capital).

The banking system has a robust capital surplus, even considering both the conclusion of the prudential adjustments timetable in 2018 and the progress of Basel III schedule, presenting sound capital ratios and immaterial projected capital shortfall. Therefore, solvency does not impose a risk for financial stability. Prospectively, the fully-fledged Basel III framework, combined with the recovery of credit growth, may contribute for a relative stability of the system's capital ratios in the forthcoming periods, albeit preserving its strong capital levels.

1.5 Capital stress tests

Capital stress tests are financial stability tools for assessing the resilience of the banking system related to its ability to absorb losses in adverse macroeconomic scenarios. The tests simulate effects on the banking system's capital adequacy ratios, stemming from extreme shocks in the main economic-financial variables. In addition, simulations of sensitivity analysis to the main risk factors taken individually and contagion among financial institutions⁴³ are conducted.

Stress tests results indicate that the banking system maintains its loss absorbing capacity against all simulated shocks, with no relevant capital shortfalls due to non-compliance⁴⁴ nor insolvency events. The results are the consequence of the appropriate capitalization cushion it currently presents, as well as the widespread use of hedge instruments which limit the impact stemming from the exposures to the mains risk factors.

Sensitivity analysis keeps pointing to a low impact on banks' capital assuming severe shocks on FX rates, once mostly banks exposures to exchange rates are hedged.

43/ The scope of the contagion simulations reach all authorized institutions to operate by the BCB, except credit unions and consortiums. The scope of macroeconomic stress tests comprehends only banks.

44/ A financial institution is considered as non-compliant if it does not comply with at least one of the capital requirement ratios: capital ratio, additional Tier 1 and CET1.

Nevertheless, shocks on interest rates point to some risks arising from abrupt increases in rates. Regarding credit risk, the system has showed lower capital shortfalls compared to the December 2017 test.

The sensitivity to residential real estate prices demonstrates slightly higher capital shortfalls with respect to December 2017 simulation, albeit not reflecting any relevant risks from exposures to mortgages on banks' balance sheet.

1.5.1 Scenario analysis – Macroeconomic stress tests⁴⁵

Table 1.5.1.1 displays the economic variables forecasts for December 2019, comprehending all the stress test scenarios: Baseline, Stressed Vector Autoregressive (VAR), Structural Break and Worst Historical.

Table 1.5.1.1 - Macroeconomic Stressed Scenarios (december/2019)

Variables \ Scenarios	Jun 2018	Base Scenario ^{1/}	Adverse Scenarios ^{3/}		
			Stressed VAR ($\alpha = 5\%$)	Structural Break	Worst Historical
Output (IBC-Br)	1,5%	2,7%	-4,0%	-4,9%	-3,8%
Brazilian benchmark interest rate (Selic)	7,4%	7,2%	10,0%	5,1%	6,5%
Exchange Rate (BRL/USD)	3,61	3,67	6,40	6,20	6,21
Inflation (annual IPCA)	4,4%	4,0%	8,1%	8,2%	4,5%
Unemployment (PNAD-C IBGE)	12,4%	12,4%	22,3%	16,5%	12,7%
Country Risk (Brazil EMBI+) ^{2/}	296	296	296	455	645
Foreign Int. Rates (US G. Bonds Yield 10yr) ^{4/}	2,9%	1,4%	3,3%	4,9%	2,9%

1/ GDP preview, SELIC Rate, FX and inflation are the risk factors were collected from the June 29th, 2018 Focus survey. The unemployment and country risk remain constant.

2/ The table shows the maximum values for the EMBI+Brazil in each scenario. For the Stressed VAR scenario, the EMBI+Brazil peak of 488 is reached in Dec, 2018 gradually returning to its present value in Dec, 2019. On the other hand, the EMBI+Brazil peak is reached in Jun, 2019 in the Structural Break scenario and in Dec, 2019 in the Worst Historical scenario.

3/ The method employed for building each scenario can be found in the annex Concepts and methodologies - Capital stress.

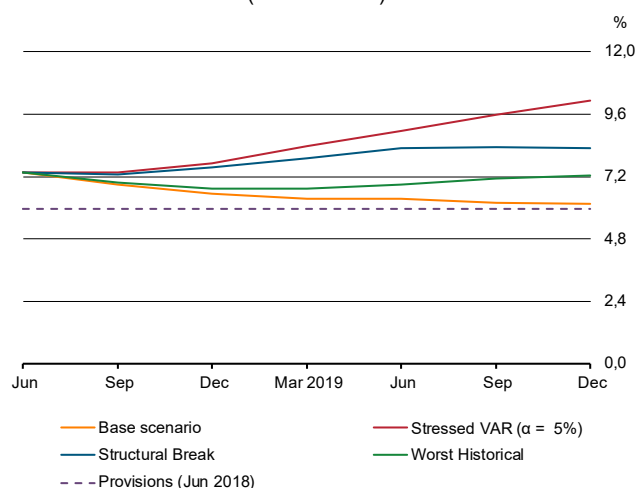
4/ The trajectories of the US G. Bonds Yield 10yr were extracted from the Federal Reserve (FED) in Dodd-Frank Act Stress Testing (DFAST) 2018 (<https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20180201a1.pdf>). For the Baseline scenario, the DFAST Adverse scenario is used. For the Stressed VAR and Structural Break scenarios, the DFAST Baseline scenario is used.

[Statistical annex](#)

The Stressed VAR scenario is designed by assuming the banking system's lowest earnings before taxes based on four projections estimated from a VAR model. The Structural Break scenario, from June 2018 onwards, is obtained by applying the changes observed of economic variables in previous periods, on the current levels by

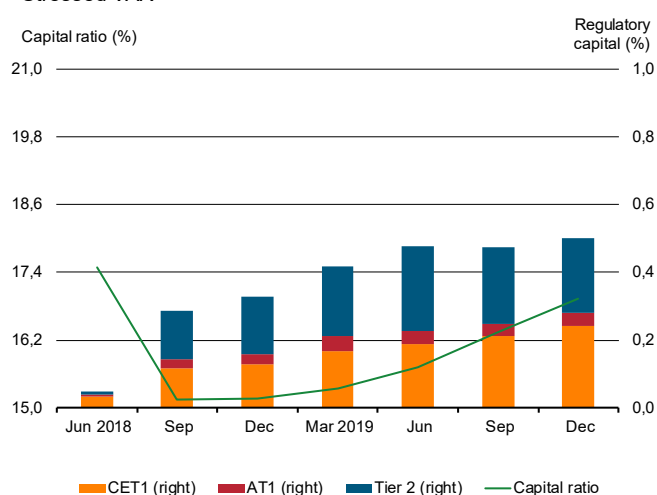
45/ The stress test assumptions are in accordance with the Resolution no. 4,680.

Chart 1.5.1.1 – Macroeconomic stress test
Problem assets forecast (% total credit)



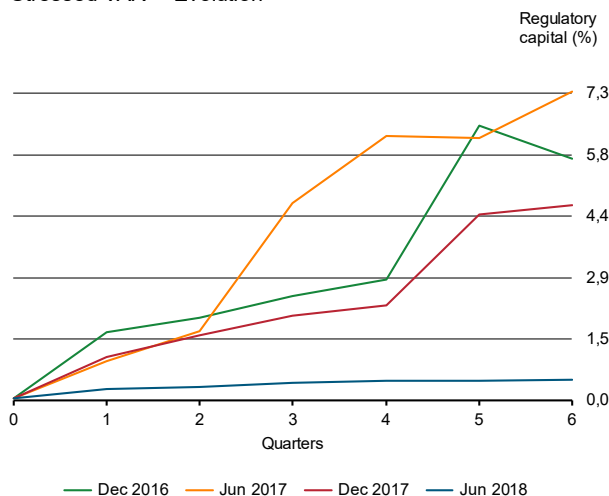
[Statistical annex](#)

Chart 1.5.1.2 – Capital requirement gap and Capital ratio
Stressed VAR



[Statistical annex](#)

Chart 1.5.1.3 – Capital requirement gap
Stressed VAR – Evolution



[Statistical annex](#)

making use of a quarterly rolling window. For each variable independently is chosen the financial system's most unfavorable historic path in a twelve-month horizon. The Worst Historical scenario simulates the historical behavior of each variable by choosing the patterns observed in a six quarter rolling window since July 2003 that would result in the banking system's lowest earnings before taxes.

The Chart 1.5.1.1 features the proportion of problem assets to total credit portfolio, for all scenarios. Delinquency plus projected restructured credit would peak 10.1% in December 2019, 4 p.p. above December 2017 estimations in the Stressed VAR scenario.

The estimated additional capital⁴⁶ that would be needed in order to avoid both noncompliance and dividends distribution limitations amounts to 0.5% of the current regulatory capital (Chart 1.5.1.2). In addition, the banking system has improved its capital position under the Stressed VAR scenario since the aggregate capital shortfall has showed a significant decline when compared to the results of the exercise of previous quarters (Chart 1.5.1.3). This improvement can be explained by a combination of three factors: i) banks that once would require additional capital due to the stressed scenario have improved their capital position and profitability; ii) phasing out of Basel III capital requirements, mainly related to the deductions from capital and; iii) differences in the projected scenarios.

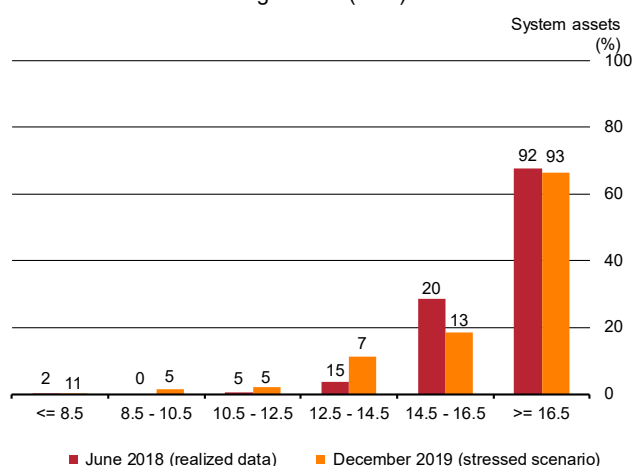
The dispersion analysis of the aggregate capital ratio demonstrates that most of the institutions would continue to have capital adequacy ratios above the minimum regulatory requirements (10.5%). This group represents about 98% of the total assets of the banking system (Chart 1.5.1.4).

1.5.2 Sensitivity analysis

Sensitivity analysis assesses the impact on banking system's capital from incremental changes in interest rates, foreign exchange rates, problem assets and valuation of mortgages collaterals, all of them independently. Regarding interest rates and FX, changes in either way (positive or negative) are allowed since they can

^{46/} The concept of capital shortfall encompasses the amount necessary to avoid both minimum capital non-compliances as well as limitations on profits distributions imposed by Resolution no. 4,193, from March 1st, 2013, in which systemically important financial institutions are subject to the systemic buffer requirement.

Chart 1.5.1.4 – Macroeconomic Stress Test
Frequency distribution of system assets by Capital ratio band - Stressed Vector Autoregressive (VAR)^{1/}



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

[Statistical annex](#)

denote gains or losses for banks. On the other hand, only increases (positive changes) of problem assets and reductions (negative changes) in values of mortgages collaterals are considered.

The shocks alter both interest rates as well as FX, individually and in steps of 10%, over a range of values with lower and upper bounds corresponding to 10% and 200% of the actual values, respectively. The FX sensitivity analysis showed no additional capital required within this interval. When considering interest risk, if rates increase 40% over the actual values, the additional capital needed in order to avoid non-compliance with capital requirements would amount to 0.12% of the actual aggregate regulatory capital. If rates rise to 100%, the capital shortfall would increase to 8.8%. It is important to point out that these are parallel shocks. Nonetheless, since the longer maturities are the ones that generate larger losses, and thus more volatility, the actual interest rate behavior and the volatility of both internal as well as external markets might lead to an increase in interest rate risk.

The results of the sensitivity test to incremental shocks of credit risk (Chart 1.5.2.1) indicate that if problem assets reach 9.4%, close to the highest level in December 2000⁴⁷, capital shortfalls would amount to 0.1% of the banking system total regulatory capital. In case of extreme scenarios where the proportion of problem assets reach 18.3% of the credit portfolio, the capital shortfall would be equivalent to 4.1% of the system regulatory capital, and banks that would need additional capital represent 58.7% of the system' assets. The additional capital required is slightly lower than the one observed in December 2017.

Collateral prices evaluation indicates that there is no regulatory breaching or dividends distribution limitation for nominal reductions of up to 35%. Only a drop of 50% or more in prices would lead to insolvency, characterized by negative regulatory capital (Chart 1.5.2.2).

In June 2018, the average loan-to-value (LTV) on mortgages outstanding balance was 61.6%, when revaluing collateral prices by the Residential Mortgage Collateral Value Index (IVG-R)⁴⁸. Low LTV on new mortgages and constant amortization system improve the

47/ Before January 2012, the proportion of E-H rated loans to total credit portfolio is used for comparison.

48/ According to the Resolution no. 4,192, from March 1st, 2013.

financial system loss absorbing capacity since they reduce the LTV throughout the maturity of the loan.

Hence, sensitivity analysis reinforces the soundness of the Brazilian financial system as capital shortfalls would only materialize under extreme and very unlikely conditions.

Therefore, sensitivity analysis confirms that the Brazilian banking system shows sound absorbing loss capacity once relevant capital shortfalls would only happen in extremely adverse situations. The results of the stress tests simulations suggest that the banking system has an adequate capital cushion in order to withstand to severe shocks resulting from the worsening of economic fundamentals.

1.5.3 Simulation of direct interbank contagion

In addition to the macroeconomic and sensitivity stress tests, we conducted direct inter-financial contagion simulations. It included all financial entities authorized by the Central Bank except for credit unions and consortiums, and all direct inter-financial exposures. However, second order effects such as fire sales or liquidity are not considered.

We simulate the failure of every financial institution, one at a time, and assess the impact this has on its counterparties. If the simulated failure of one institution makes any of its counterparties to fail as well, we simulate additional rounds until we reach a new equilibrium (domino effect). The impacts result from the write-off of exposures to different instruments, such as interbank deposits, granting of guarantees, OTC derivatives and any other entailing credit risk, in which there are neither third-party guarantees nor collateral. We then analyze the necessary additional capital that would be required to prevent the contagion from propagating.

The results show a low capital shortfall in case of default of each institution separately. In the worst scenario, the figure is less than 1% of the regulatory capital of the entire system. Two points help explain this result. First, the regulatory cap of 25% on exposures to any single counterparty, as a proportion of the creditor institution's capital. Second, that the great majority of inter-financial transactions occurs through repurchase agreements collateralized by federal bonds, which are not included in the contagion. The remaining operations, although

small in aggregate volume in the financial system, may be relevant in some particular cases, which explains the situation described above.

1.6 Financial Stability Survey

1.6.1 Introduction

This section presents the latest results from the Financial Stability Survey (FSS). The survey is conducted on a quarterly basis with selected financial institutions and aims to identify and follow sources of risk to financial stability, as perceived by regulated institutions.

The FSS sample comprises 55 financial institutions, covering 95% of the Brazilian National Financial System (SFN) in terms of assets, including public banks, development banks, foreign banks, and private Brazilian banks with and without foreign shareholders.

Since the latest edition of the Financial Stability Report (FSR), two survey rounds were run, from May 3rd to 21st, 2018 and August 2nd to 16th, 2018, both with response rates of 100%. This section compares the results from these FSS rounds with those from the FSS run from February 5th to 19th, published in the April 2018 FSR .

1.6.2 Risks to financial stability

The BCB asked survey respondents about their perception of the main risks to the financial stability in the next three years, considering their occurrence probability and impact on the SFN.⁴⁹ Each institution can freely describe up to three sources of risk, which are then classified by the BCB into different risk categories for the purpose of analyzing the results (Table 1.6.2.1).⁵⁰

The frequency of risks related to the foreign scenario grew in the recent period, leading this risk category to the top of the most cited by financial institutions. Their

Table 1.6.2.1 – FSS – The most cited risk factors

Risk	Frequency (%)			Probability	Impact
	Feb 2018	May 2018	Aug 2018	Aug 2018	
Foreign Scenario	51	49	76	Mid-High	Medium
Political Risks	64	71	67	Mid-High	High
Delinquency and Recession	56	58	55	Mid-High	Medium
Fiscal Risks	56	49	44	Mid-High	High

[Statistical annex](#)

49/ Question: “In the next three years, what are the risks to the financial stability that your institution consider most relevant considering probability and impact on the SFN? Describe the three risks in order of importance (the most important first, considering the combination of probability of occurrence of the event and the magnitude of the impact in terms of losses measured as a fraction of the total assets of the SFN).”

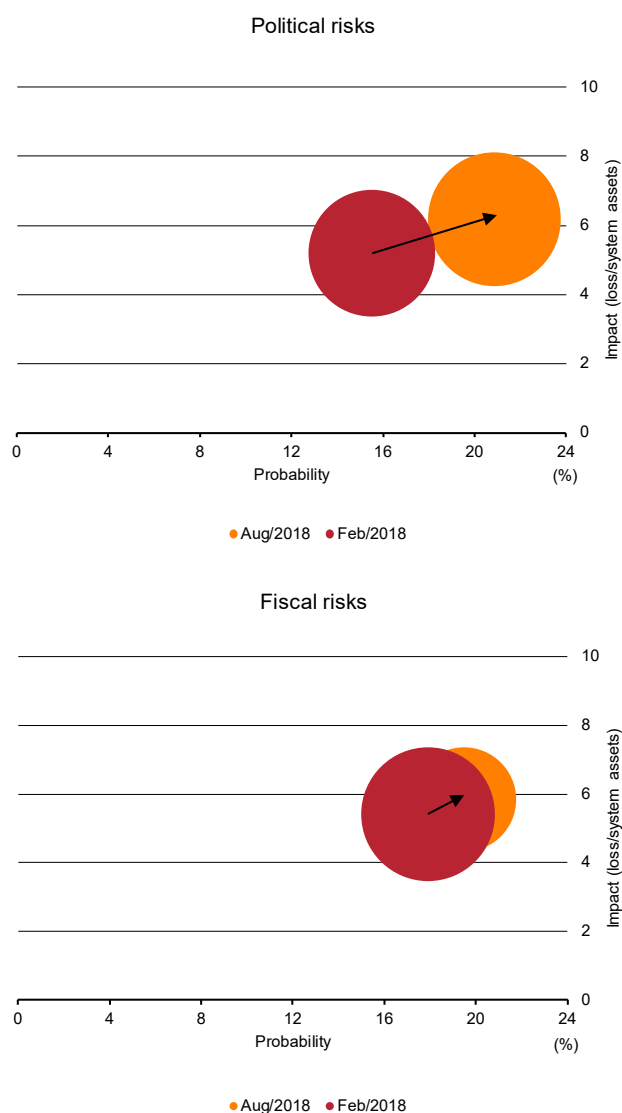
50/ Since the same institution can describe two or more risks that could later be classified into the same risk category (for example monetary policy in the US and trade war), the reported frequency does not necessarily correspond to the number of institutions that quoted a given risk category.

Table 1.6.2.2 – FSS – Citation frequency of the most important risk

Risk	Frequency (%)			Probability	Impact
	Feb 2018	May 2018	Aug 2018		
Political Risks	36	49	51	Mid-High	High
Delinquency and Recession	20	16	18	Mid-High	Medium
Fiscal Risks	31	24	16	Mid-High	High
Foreign Scenario	5	4	9	Mid-High	Medium

[Statistical annex](#)

Chart 1.6.2.1 – FSS – Cited risks: probability, impact and frequency



citation frequency rose from 51% in February 2018 to 76% in the last survey. The main reason for this increase was the citation of new foreign scenario risks. Previously, the quotation of foreign risks by respondents was limited to events such as the withdrawal of monetary stimulus in the United States and its impact on emerging economies, such as through currency depreciation and rising funding costs. Now, the citation of foreign risks also includes concerns about the rising trade tensions and the contagion coming from tensions in Turkey and Argentina. Many respondents pointed out that the trade war, especially between the United States and China, could reduce the volume of international trade, influencing commodity prices and the level of world activity.

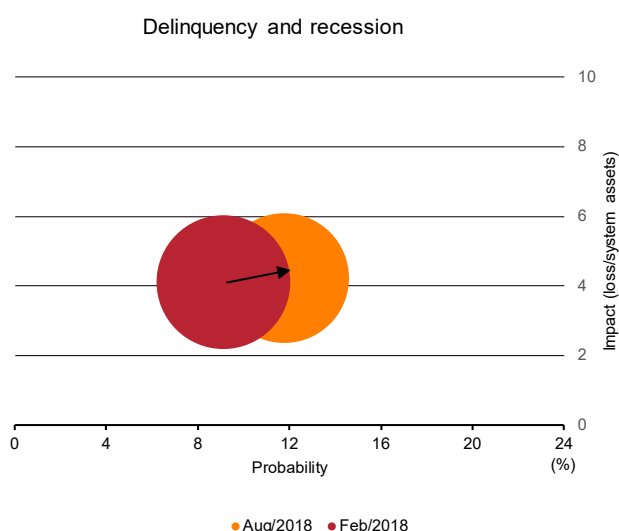
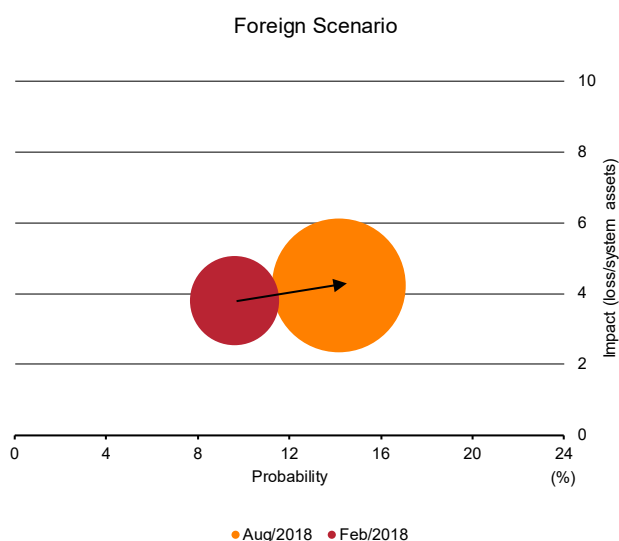
The concern with political risks remains high, cited by 67%. The political risks pointed out by the institutions are basically related to uncertainties associated with the presidential elections, such as the outcome of the elections, the program of the elected candidate and the governability conditions.

The frequency of fiscal risks citations dropped from 56% in February 2018 to 44% in August 2018, while the risks citations associated with delinquency and recession, after a sequence of drops, remained relatively stable in the last two surveys, cited by 55% of respondents in August 2018. This result reflects the more gradual pace of the Brazilian economy recovery.

When considering only the most important risk among the three reported by respondents, political risks were the most worrying factor, being cited by 51% of institutions in August 2018, compared to 36% in February 2018, with medium-high probability and high impact on the financial system (Table 1.6.2.2). Under this view, the risks associated to the foreign scenario are the least worrisome among the four analyzed risk categories.

However, there was an increase in the likelihood and corresponding impact on the financial system attributed by institutions to the four mentioned risk categories (political, fiscal, foreign scenario and delinquency and recession risks)⁵¹ (Chart 1.6.2.1). According to respondents, political risks had the sharpest increase in probability and constitute the risk with greater probability and impact.

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



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

[Statistical annex](#)

Financial institutions also consider political risks (44% of citations) as the most difficult to mitigate with the adoption of internal strategies.⁵²

The most relevant transmission channels of events pointed out by respondents were a sharp drop in asset prices, increased risk aversion and uncertainty, capital flight, currency depreciation and credit downgrade (Table 1.6.2.3).⁵³

52/ 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 of the Central Bank and/or the Federal Government?” The response may involve more than one risk, so that the sum of frequencies may exceed 100%.

53/ Question: “In the case of the occurrence of the most relevant event of high impact, what is the probability that this shock will be transmitted by the following channels?” The reported numbers represent the median of the answers. The last column shows the distribution of responses from the last survey.

Table 1.6.2.3 – FSS – Transmission channels of high impact events

Transmission channel	Feb 2018 (median)	May 2018 (median)	Aug 2018 (median)	Distribution (last survey)
Contagion between markets and domestic institutions	3	4	3	
Liquidity squeeze, including interbank markets and foreign credit	3	3	3	
Sharp decline in domestic financial asset prices, including collateral prices	3	3	4	
Increase in risk aversion and uncertainty, affecting consumption and investment decisions	4	4	4	
Decline in depositors confidence, including flight-to-safety	3	3	3	
Capital flight or strong currency depreciation	4	4	4	
Widespread credit rating downgrade, including sovereign ratings	4	4	4	

Very low

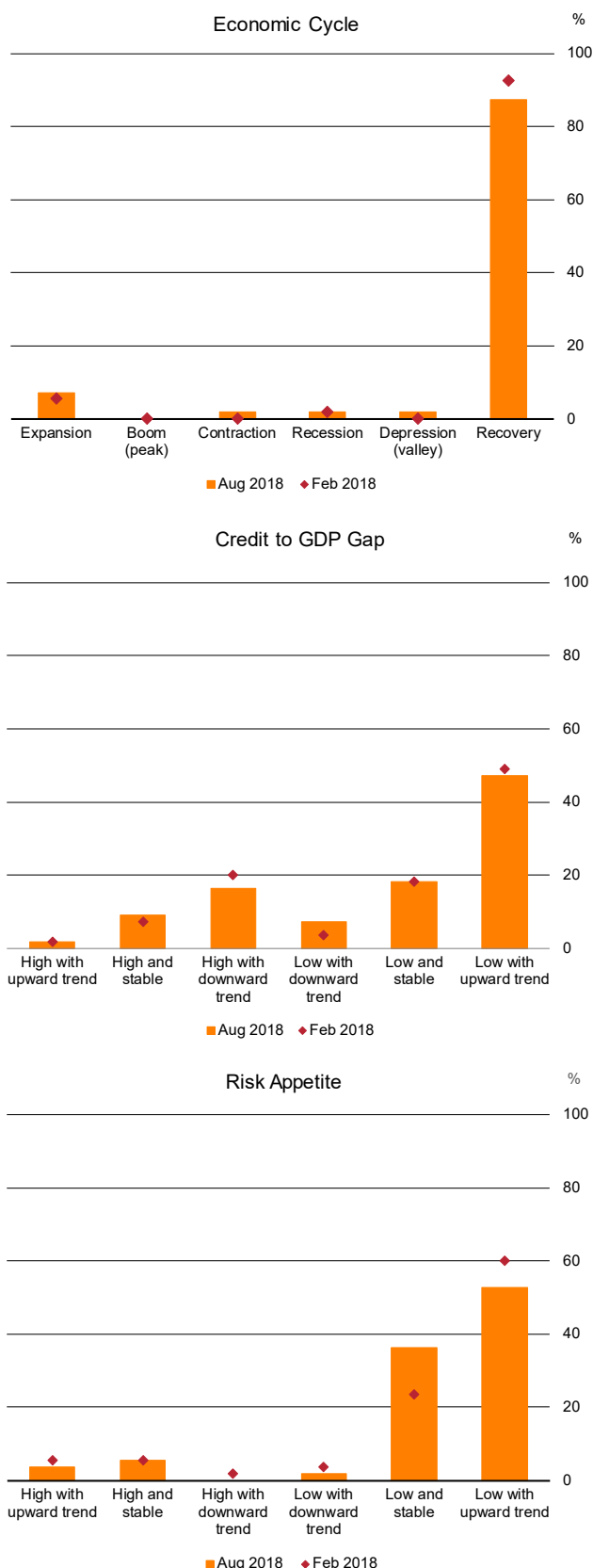
Probability

1 2 3 4 5 6

Very high

[Statistical annex](#)

Chart 1.6.3.1 – FSS – Economic and financial cycles



1.6.3 Financial and economic cycles

The economic activity recovery remains relatively stable. Most respondents (87%) believe that the economy is in the recovery phase (Chart 1.6.3.1).

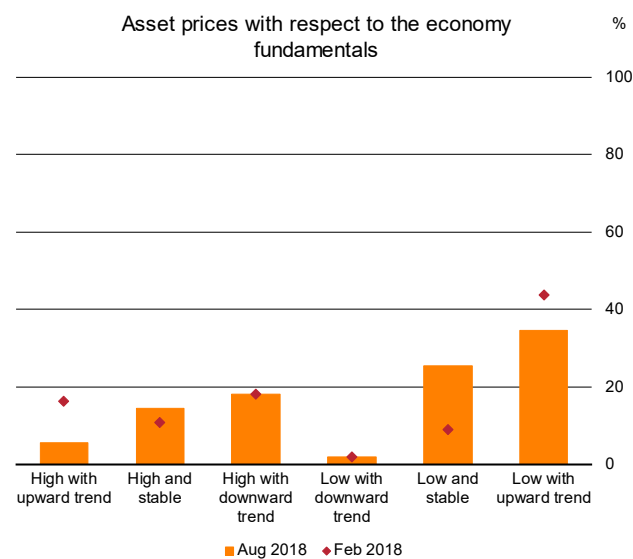
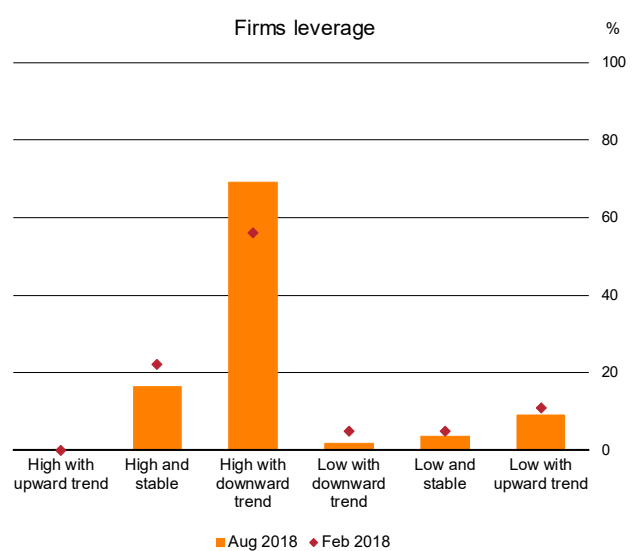
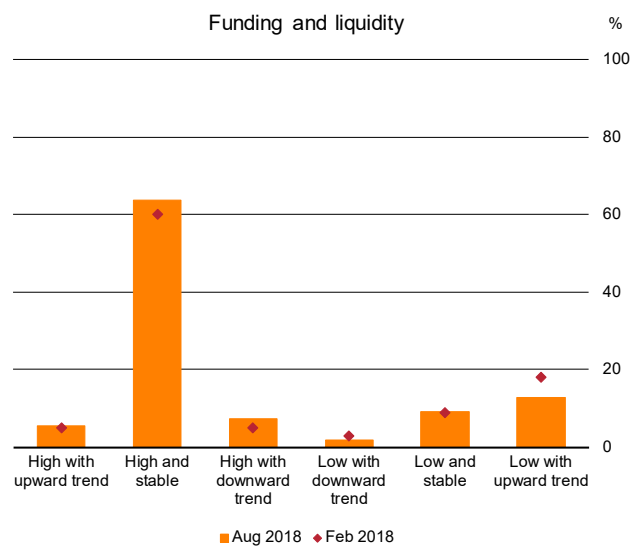
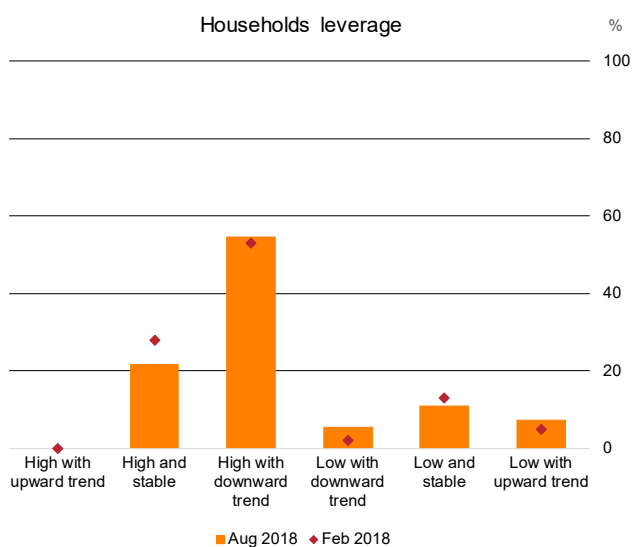
The institutions' perception of the credit to GDP gap also did not change significantly. The credit gap is low (73% of respondents, considering the three corresponding categories), but with an upward trend (47% of respondents).

According to the survey, the trend of increasing willingness of financial institutions to take risk lost strength in the last survey. The participation of those who consider that the risk appetite is low, but with an upward trend, went from 60% in February to 53% in August 2018, increasing the participation of those who consider that the risk appetite is low and stable (from 24% to 36%). The reduction of the impetus for risk-taking is consistent with the scenario of greater risk identified by respondents.

The households and firms leverage is still considered high by financial institutions, although with a downward trend. According to respondents, the level of household leverage did not change significantly in the period, with the majority (55% in August, compared to 53% in February 2018), concentrating responses in the "high with a downward trend." In the case of firms, there was a significant increase of responses in this category (69% in August, compared to 56% in February).

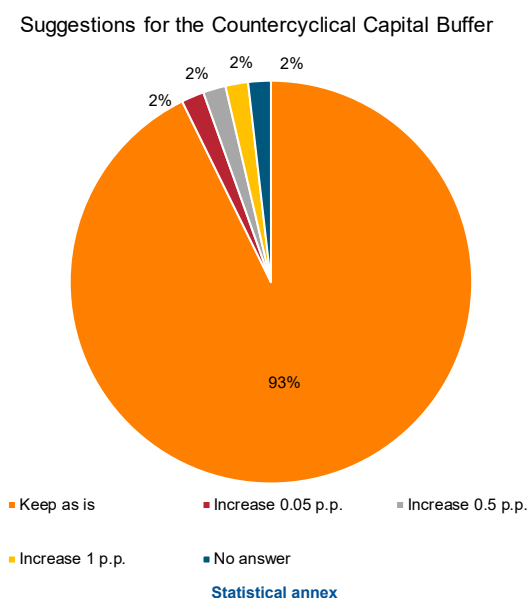
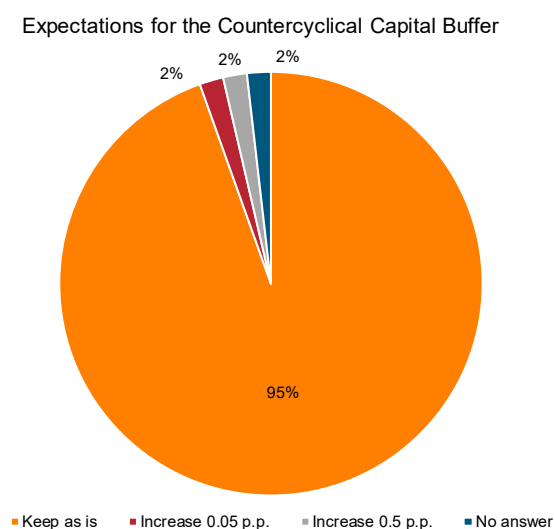
In general, there is a high degree of agreement among financial institutions that funding and liquidity remain high, with 64% of responses concentrated in the "high and stable" in August, compared to 60% in the survey of February. In the same period, there was a reduction from 18% to 13% in the frequency of the "low with upward trend."

Regarding asset prices and economy fundamentals, there was a decrease in the upward trend perception. Considering the sum of the two categories with an upward trend ("high with upward trend" and "low with upward trend"), the percentage of respondents fell from 60% in February to 40% in August 2018. The category "low and stable" went from 9% to 25% on the same comparison.



[Statistical annex](#)

Chart 1.6.4.1 – FSS – Expectations for the Countercyclical Capital Buffer



1.6.4 Expectations for the Countercyclical Capital Buffer

Following the recommendations of the Basel Committee for Banking Supervision (Basel III), the Financial Stability Committee (Comef) is the body responsible for defining and reporting the value of the Countercyclical Capital Buffer for Brazil (ACCP_{Brasil}). In the August survey, most financial institutions expected (95% of responses) and recommended (93% of responses) keeping the value of ACCP_{Brasil} at zero percent (Chart 1.6.4.1). The decision of the Comef meeting on September 4th, 2018, was to maintain the value at zero percent.

1.6.5 Resilience and confidence in the financial system stability

The perception of the resilience conditions of the SFN⁵⁴ remains positive (Table 1.6.5.1). The results show a high level of agreement among institutions on the suitability and adequacy of the available instruments to deal with a serious financial crisis, if materialized. For each of the considered aspects, about 86% of respondents classified their answers in the “very satisfactory” and “satisfactory” classes in the last three FSS surveys.

54/ Question: “How does your institution evaluate the responsiveness of the financial system to the event described in field 1.1? (Scale the degree of satisfaction from 1 to 6, 1 being very satisfactory and 6 being very unsatisfactory)”

Table 1.6.5.1 – FSS – Financial system capacity of reacting to high impact events

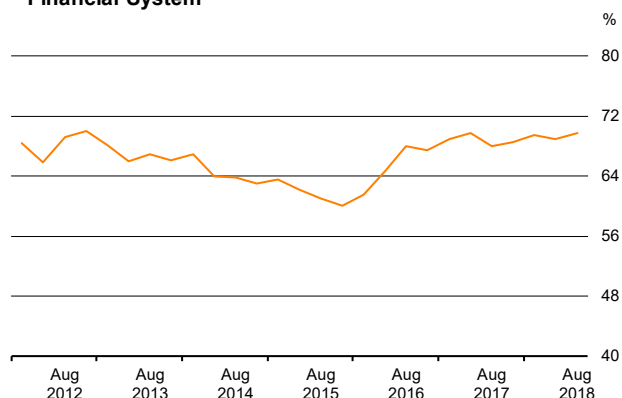
Financial system resilience factors	Feb 2018 (median)	May 2018 (median)	Aug 2018 (median)	Distribution (last survey)
Financial system capital adequacy	2	2	2	
Financial system liquidity adequacy	2	2	2	
Financial institutions monitoring and attention	2	2	2	
Government and Regulatory Agencies monitoring and attention	2	2	2	
Instrumental availability for risk prevention and mitigation by the BCB	2	2	2	

Median of the distribution of reaction capacities

Satisfactory 1 2 3 4 5 6 Unsatisfactory

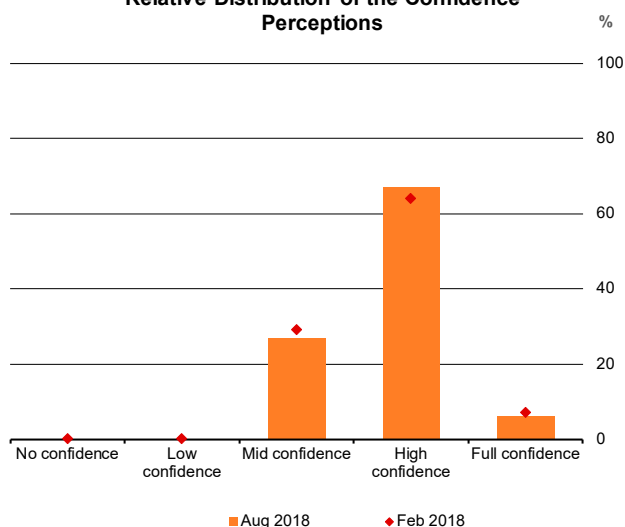
[Statistical annex](#)

Chart 1.6.5.1 – FSS – Confidence in the stability of the Financial System



[Statistical annex](#)

Relative Distribution of the Confidence Perceptions



[Statistical annex](#)

The financial stability confidence index⁵⁵ has remained high and stable, with no negative citations (classes: “no confidence” and “low confidence”) recorded in the last nine quarters (Chart 1.6.5.1).

Therefore, despite the prospective scenario of greater risk, the institutions surveyed trust on the resilience and stability of the financial system.

1.6.6 Final remarks

According to the perceptions of financial institutions, the risks in the prospective scenario have increased, considering the associated probabilities and impacts. The main highlight is political risks, which had the greatest increase in probability and constitute, according to the respondents, the risk of greater probability and impact. The risks associated with the foreign scenario are also gaining momentum. Quotations of this risk were limited to the withdrawal of monetary stimulus in the United States in previous surveys, but now also include concerns about rising trade tensions.

The perception about the economic and credit cycle remains relatively stable, although with a slight reduction of optimism. The willingness to take risks decreased, consistent with a scenario of greater risk perceived by respondents. The perception about the asset price is less bullish. Most financial institutions believe that the leverage of firms and households is still high, but shows a downward trend.

The expressive majority of respondents expects and recommends maintaining the value of the Countercyclical Capital Buffer at zero percent, which effectively occurred, suggesting alignment of expectations with respect to the capital buffer needed to ensure the stability of the financial system.

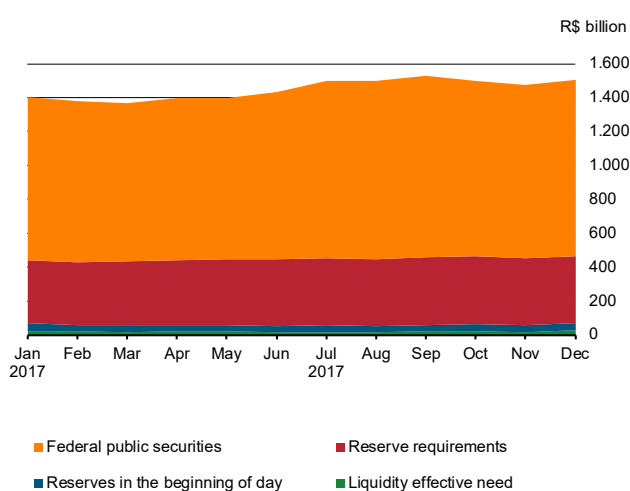
Confidence in the financial stability has remained high and the ability of the financial system to respond to relevant events is considered satisfactory.

^{55/} Question: “What is the degree of confidence in the stability of the SFN in the next three years?” The confidence index is calculated by weighing the responses according to the following weights (multiplied by 100): full confidence (1); high confidence (0.75); mid confidence (0.5); low confidence (0.25), and lack of confidence (0).

1.7 Systemically important financial market infrastructures

In the first half of 2018, the systemically important financial market infrastructures (FMIs) observed a safe and efficient operation. In the Reserves Transfer System (STR), the sole systemically important funds transfer system, the aggregate balance of funds available for payments and interbank transfers – named intraday liquidity – remained above the effective needs of participating financial institutions, assuring the smooth functioning of settlement operations. During the semester, on average, the need for funds – liquidity effective need – of the system was 1.8% of available liquidity, with a peak of 9.0% observed in the period.

Chart 1.7.1 – Liquidity effective need



[Statistical annex](#)

Federal public securities held by financial institutions in their portfolios and reserve requirements held at BCB contribute to the system's high liquidity level (Chart 1.7.1). Reserve requirements balances can be transferred to the reserves accounts and TPFs may be converted into central bank money through intraday repo operations, both with no intraday financial cost to the financial institution. A high and stable level of intraday liquidity allowing an uninterrupted flow of payments, removing incentives for liquidity retention and risk of insufficient resources for settlement of obligations throughout the day.

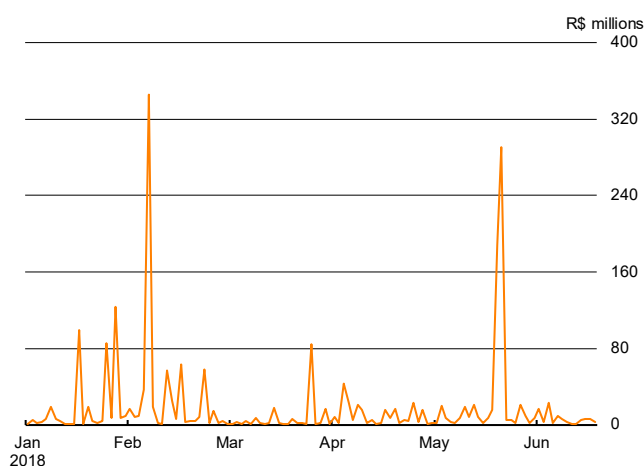
The BCB performs monthly backtesting analyses for securities clearing and settlement systems for transactions with securities, derivatives and foreign currency, in which there is an entity acting as central counterparty (CCP). The aim of this analysis is to establish i) the adequacy of the amount of additional⁵⁶ collaterals and safeguards to cover the default of the two participants with the most critical financial exposure (credit risk) and ii) the existence of a sufficient amount of liquid resources to guarantee the timely settlement of obligations assumed by the two participants with the highest financial obligations (liquidity risk) on every day evaluated.

A participant's Net Financial Risk (RFL) is a metric used to assess its credit risk. It consists of the comparison between the financial result arising from the simulation of the closing of the positions⁵⁷ and the guarantees of a defaulting participant. Both systems evaluated - BM&FBovespa FX and BM&FBovespa Clearinghouse,

56/ Each system has a fund available for the CCP to deal with the credit risk that exceeds the value of the investors' guarantees.

57/ Calculated by the CCP based on the strategy for closure and on the actual variation of asset prices, assessed on the subsequent days.

Chart 1.7.2 – BM&FBOVESPA Clearinghouse
Net Financial Risk



Sources: BM&FBOVESPA and BCB

[Statistical annex](#)

Table 1.7.1 – BM&FBOVESPA Clearinghouse
Primitive Risk Factors (PRF)

Discrimination	Low ^{1/}	High ^{1/}
Ibovespa spot	40%	40%
USD spot	45%	28%
Fixed rate 42	51%	47%
Fixed rate 126	42%	56%
Fixed rate 252	38%	59%
Fixed rate 756	33%	30%
DDI ^{2/} 180	24%	12%
DDI 360	25%	18%
DDI 1080	26%	17%

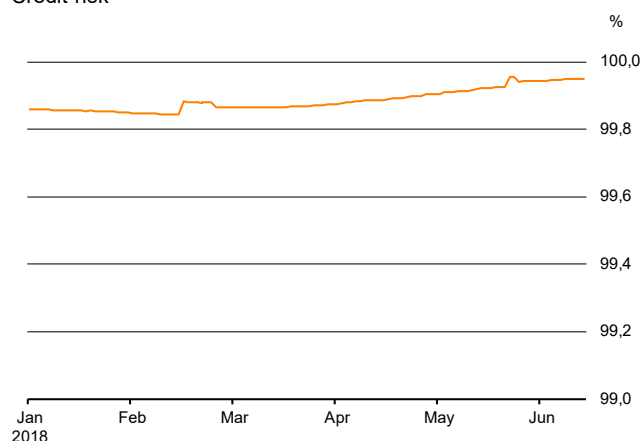
Sources: BM&FBOVESPA and BCB

1/ Second semester of 2017.

2/ Foreign exchange coupon.

[Statistical annex](#)

Chart 1.7.3 – BM&FBOVESPA Clearinghouse
Credit risk*



* Accuracy estimates from the model for individual margin evaluation with a rolling window of the last three months (63 days).

[Statistical annex](#)

operated by B3 S.A. - presented satisfactory results during the first semester of 2018. In both systems, the sum of the RFL of their two participants with the largest financial exposures did not exceed the value of the assets that make up the additional safeguards of that system.

In the BM&FBovespa Clearinghouse, the RFL, considering the two participants with the largest exposures, corresponded to 27.13% of the additional safeguards available on the day it reached its maximum value (Chart 1.7.2). In the foreign exchange clearinghouse, the RFL was null every day.

Still regarding the BM&FBovespa Clearinghouse, Table 1.7.1 shows, in the first half of 2018, two-day accumulated changes in main Primitive Risk Factors' value⁵⁸ remained within the limits established in their stress scenarios. The table shows the highest observed percentage in the period for the ratio between two-day accumulated return and the respective high or low scenario.

The accuracy estimate⁵⁹ of the risk model used by BM&FBovespa Clearinghouse remained above 99%, considered as a reference value⁶⁰ for central counterparties (Chart 1.7.3).

Resolution 2,882, of August 30, 2001, determines that clearinghouses and other clearing and settlement providers must maintain liquid resources in order to guarantee at least, the timely settlement of the participant's obligations with the highest debtor position. Likewise, the international principles adopted by the Central Bank – Principles for Financial Market Infrastructures (PFMI)⁶¹ – recommend that a CCP, like BM&FBovespa-FX Clearinghouse must

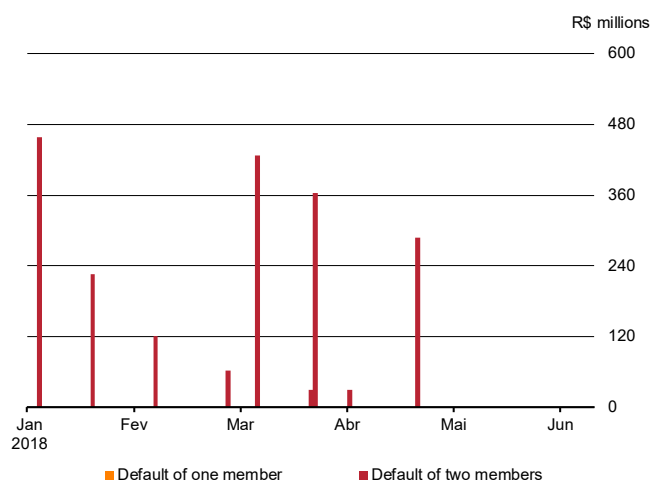
58/ The Primitive Risk Factor (PRF) associated with a derivative contract is the denomination given to the financial variables relevant to the contract's price formation.

59/ Accuracy level is defined as the correctness ratio of a risk management model within a given period.

60/ According to the Principles for Financial Market Infrastructures (PFMI – CPSS/IOSCO 2012), a CCP should use a 99% confidence level of the estimated distribution for future exposure when calculating the guarantees required for a participant or a portfolio. The accuracy estimate presented in Chart 1.7.3 is calculated in aggregated form for all individual portfolios, therefore being indirectly related to the PFMI recommendation.

61/ Published in April 2012 by the Committee on Payment and Settlement Systems of the Bank for International Settlements (CPSS/BIS) and the Technical Committee of the International Organization of Securities Commissions (TC/IOSCO)

Chart 1.7.4 – BM&FBovespa-FX Clearinghouse
Liquidity shortage R\$



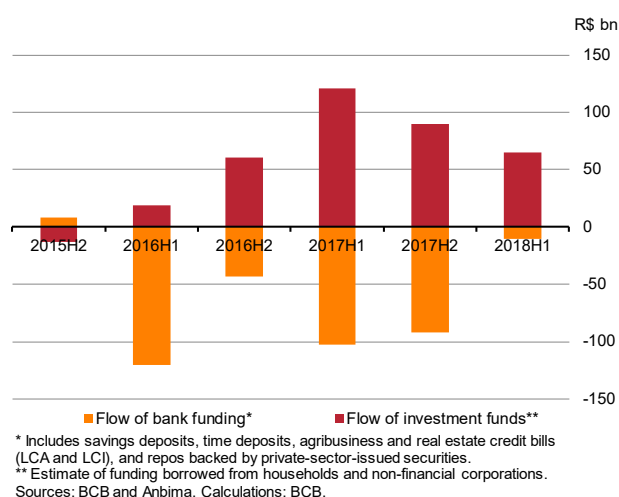
[Statistical annex](#)

maintain liquid funds to guarantee the settlement of the greatest debt position⁶².

In this respect, both BM&FBovespa-FX Clearinghouse and BM&FBovespa Clearinghouse complied with the rules and followed international recommendations. Besides, although not required by regulation and by international principles, BM&FBovespa-FX Clearinghouse maintained sufficient liquid funds to guarantee the timely settlement of the two greatest debt positions, except for nine days in the period analyzed (Chart 1.7.4).

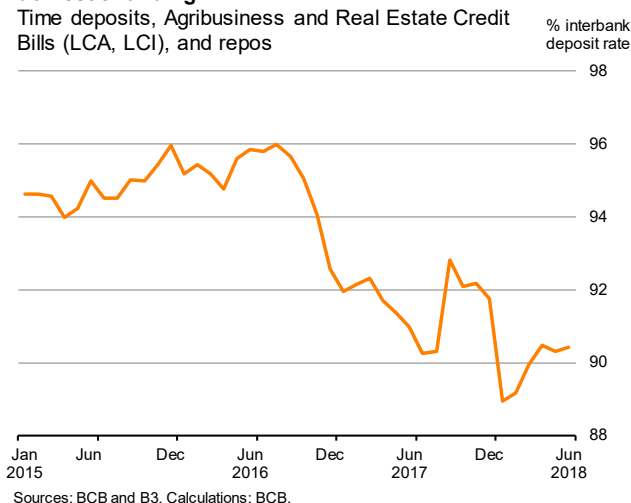
^{62/} In turn, CCPs that are considered systemically important in more than one jurisdiction, or that present a complex risk profile must maintain liquid resources sufficient to guarantee the settlement of the two greatest debt positions.

Chart 2.1.1 – Selected flows
Banks and investment funds



[Statistical annex](#)

Chart 2.1.2 – Average interest rate of large banks' domestic funding
Time deposits, Agribusiness and Real Estate Credit Bills (LCA, LCI), and repos



[Statistical annex](#)

2.1 The growth of the investment fund industry – Potential implications for financial stability

The allocation of financial resources held by the real sector of the Brazilian economy has been changing since 2016, with possible implications for financial stability in the event that this process continues. Households and firms have been investing in investment fund shares and passing over banking funding instruments⁶³ (Chart 2.1.1). Hence, the attribution of risk exposures within the system – who is exposed to which risk – has gradually been changing, and the BCB has been monitoring these changes.

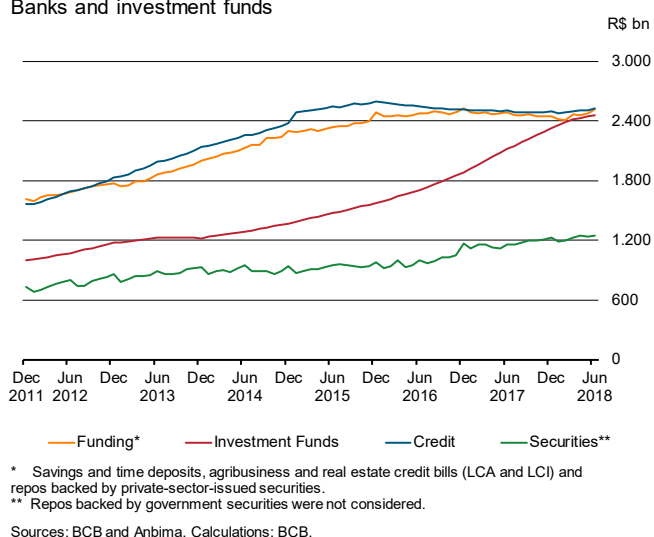
From the investors' standpoint, investments in funds became more attractive than in banks. Indeed, the largest banks have been reducing the interest rates of new funding, thereby showing little appetite for more resources⁶⁴ (Chart 2.1.2).

From the banking sector's standpoint, increasing the funding base also became less interesting. Due to the adverse economic scenario, the evolution of the credit portfolio decreased the demand for deposits (Chart 2.1.3).

63/ For this analysis, the banking system has the same scope of Section 1.1 Liquidity. Also, bank funding takes into account only domestic funding and consists of savings accounts, time deposits, agribusiness and real estate credit bills (LCA and LCI), and repos backed by private-sector-issued securities. As for the investment funds, Fixed Income, Equities, Multimarket and Foreign Exchange-Indexed were the Anbima classes taken into consideration, and were aligned with the following investors' segments: Corporate, Middle Market, Private, High Income Retail and Retail. Additionally, the entire segment of investors from Open Private Pension Funds (EAPC) was taken into consideration.

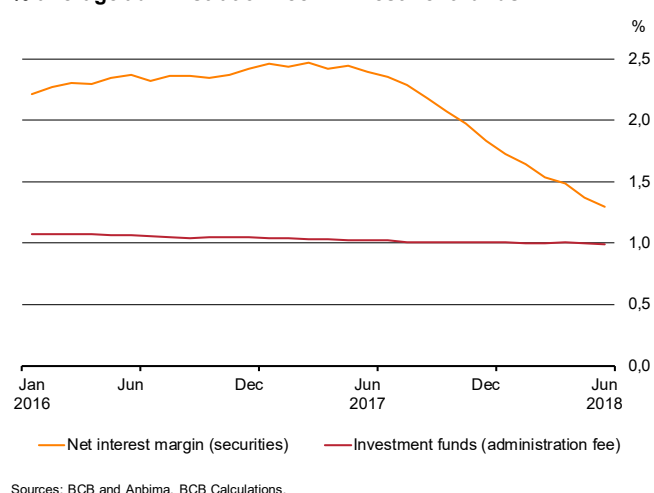
64/ The evolution of funding costs, compared to the Selic Rate decline cycle, was addressed on Chapter 2 of the 2017 Report on Banking Economics (Portuguese version available at: https://www.bcb.gov.br/pec/depep/spread/REB_2017.pdf).

Chart 2.1.3 – Balance sheet components
Banks and investment funds



[Statistical annex](#)

Chart 2.1.4 – Securities net interest margin versus % average administration fee in investment funds



[Statistical annex](#)

In addition, it became less attractive to raise funds and not to direct them to the origination of loans. Indeed, the Selic Rate reduction cycle, started in the last quarter of 2016, reduced net interest margins in securities intermediation (Chart 2.1.4). This stimulated banking conglomerates to route part of the savings from households and firms to investment funds, which provide income to these conglomerates with lower intermediation costs.⁶⁵

In this context of low policy rates, the growth of the investment fund industry can boost the capital market, providing large companies with cheaper funding than the traditional bank credit. Indeed, this phenomenon is already happening, as the portfolio of securities issued by private non-financial corporations held by the investment fund industry grew by 26.5% from December 2016 to June 2018, more than the 20% growth of the investment funds industry Net Asset Value in the period. Notwithstanding this recent rise, securities issued by the private sector continue representing a small share of funds' portfolio, approximately 7%, as opposed to 73% invested in government federal securities and repos backed by these securities.

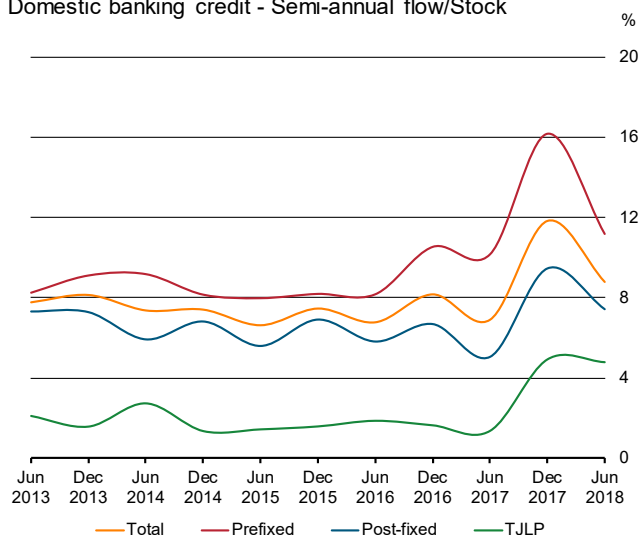
This expansion of private-sector-issued securities in the portfolio of investment funds is in line with the growth of borrowing via capital markets (Chart 1.2.5.4), which is monitored by the BCB in the broad credit metric. The growth of the fund industry brings about some concerns related to financial stability, which are also monitored by the BCB.

From the standpoint of the investor that replaces investment in bank instruments with investment in fund shares, there is a change in the risk profile. Notwithstanding the possibility of broader diversification of investments, the investment fund shares, unlike bank deposits, do not benefit from coverage by the Brazilian deposit insurance scheme Fundo Garantidor de Créditos (FGC) and are marked to market on a daily basis.

The reaction of investors to the greater volatility of returns on investments may pose consequences to markets and other financial intermediaries. Devaluations of fund shares followed by large redemption requests would put additional pressure on asset sales in a market that could be under stress, which could feedback into the process

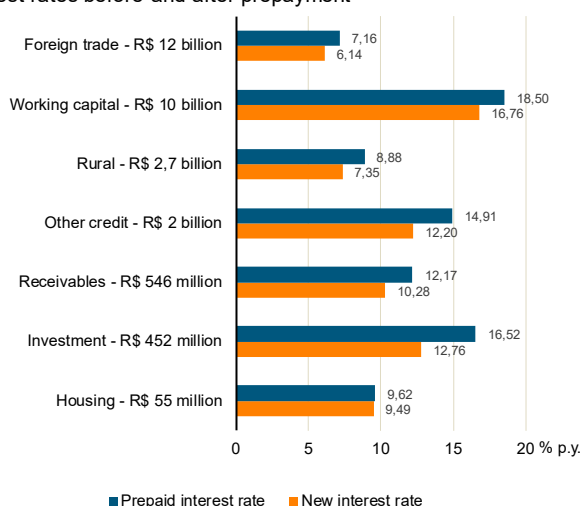
^{65/} The intermediation costs include reserve requirements, provisioning costs, contribution to the Brazilian deposit insurance Fundo Garantidor de Créditos (FGC), requirements on earmarked funding and also prudential requirements, which increased with the introduction of Basel III framework.

Chart 2.2.1 – Prepayment
Domestic banking credit - Semi-annual flow/Stock



[Statistical annex](#)

Chart 2.2.2 - Prepayment
Interest rates before and after prepayment



[Statistical annex](#)

and impose losses on other assets and economic agents, including banks, insurance companies and pension funds.

In this sense, the BCB continuously monitors not only the market but also the interconnections among agents of the Brazilian financial system,⁶⁶ in order to measure the potential risks resulting from direct and indirect linkages among these agents. Currently, the direct contagion risk is low, despite the dense network of direct connections between the banking sector and the investment funds, and among these, the insurance companies, and the pension funds.

The risk posed by indirect connections has also been monitored by the BCB,⁶⁷ by means of stress tests that measure the potential financial support that financial institutions would provide to investment funds managed by themselves in a scenario of large redemptions. The estimated amount continues at a reduced level when compared to the excess liquidity of financial conglomerates.

2.2 Companies debt prepayment, funding migration and foreign exchange hedge

Between 2016 and 2018, the term structure of the country's interest rates has significantly reduced, following the Selic rate target, which fell from 14.25% (September 2016) to 6.5% (March 2018). The decrease in the interest rate trajectory has triggered changes in the credit market for non-financial companies: with the financing cost reduction, new advantageous credit lines could be offered to these companies with more favorable conditions to pay their old debts. In addition, with the Selic rate in the historical low, contracts indexed to the long-term interest rate (TJLP) have become more expensive than other market instruments, also encouraging prepayment of debt.

The effect of this new institutional environment on pre-existing contracts should be stronger (i) the more relevant the percentage of post-fixed operations is (immediate effect) and (ii) the greater the debt repayment relevance (affecting rollovers or new granting). In fact, there is an increase in prepayment of debt since the second half of

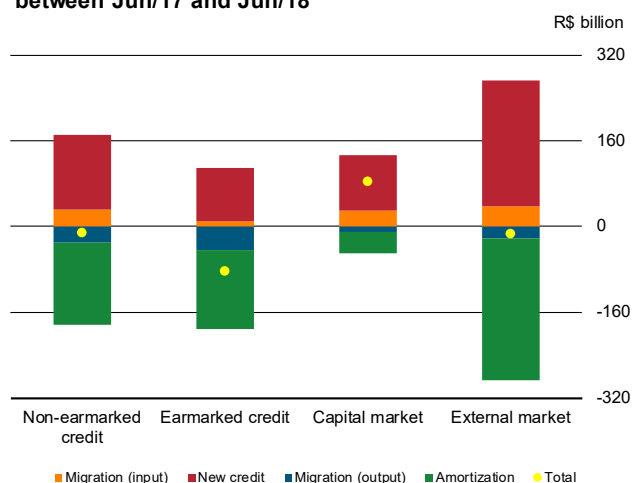
66/ Available at: https://www.bcb.gov.br/ingles/estabilidade/2018_04/fsrSection2_1.pdf

67/ Available at: https://www.bcb.gov.br/ingles/estabilidade/2017_10/fsrStepInRisk.pdf

2017, especially pre-fixed operations (Chart 2.2.1). As expected, when prepayment involves new granting,⁶⁸ this occurs at lower interest rates and is more concentrated on foreign trade and working capital (Chart 2.2.2). From the debtors' point of view, the funding migration lowers the risk by reducing the servicing of their debts.

The reduction in the Selic rate altered the composition of companies' debt. The monetary easing started in 2016 reduced the attractiveness of federal securities and encouraged the diversification of investments. With the increase in the demand for private bonds, the risk premium fell, reducing companies cost of issuing debt in the capital market. This, additionally to the change in BNDES loan policy, triggered an impressive growth in the capital market – especially corporate bonds – since the second half of 2017,⁶⁹ as indicated in Section 2 of Chapter 1.

Chart 2.2.3 – Variation in corporate debt between Jun/17 and Jun/18



[Statistical annex](#)

Capital market currently accounts for 11.3% of corporate debt. The recent expansion represents a change of traditional sources of funding (bank loans and international debt issuance) to corporate bonds and commercial notes, for some companies. Of the total increase in the capital market, BRL 29.6 billion (or 22.2%) derives from migrations. Of which, BRL 8.6 billion from non-earmarked bank loans, BRL 9.6 billion from earmarked bank loans and BRL 11.4 billion from external market (Table 2.2.1).⁷⁰ Therefore, a relevant part of the capital market increase is due to new credit (Chart 2.2.3), which will be designated to debt restructuring, working capital, investments or mergers and acquisitions financing.⁷¹

⁶⁸ The indicator presented here refers to new loans made by the same company, in the same modalities, with amount proportional to the previous ones. The figures shown refer to the granting made under these conditions by all Brazilian companies in the first half of 2018. The methodology to determine the prepayment was the same used for Graph 2.2.1, 62% of prepayment outstanding in the period was made by companies that made new loans.

⁶⁹ Between June 2017 and June 2018, the capital market registered increase of BRL 84.1 bi, or 31.7%.

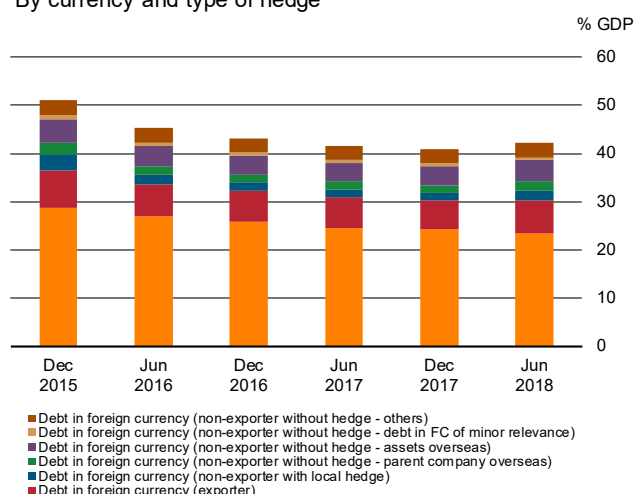
⁷⁰ For these indicators, the exposure of each economic group was calculated in each of the different fund sources. The migration amount, when it involved more than one fund source, was allocated on a pro rata basis. The “new credits” (amortization) is the residual variation of each fund source: positive (negative) figures, therefore, refer to the increase (decrease) on the referred fund source, after the removal of the migration effect. For the estimation of the migration, the exchange rate variation was disregarded in the period.

⁷¹ For the destination of the corporate debt resources, see Capital Markets Bulletin, at Anbima's website. In the first half of 2018, 29.3% was destined to liabilities refinancing, 26.7% for working capital and 17.6% for infrastructure investment.

Table 2.2.1 - Migration matrix (June/2017 to June/2018)

R\$ billion

		Destiny				
		Non-earmarked credit	Earmarked credit	Capital market	External market	Total
Origin	Non-earmarked credit		5,9	8,6	14,7	29,2
	Earmarked credit	19,0		9,6	16,1	44,7
	Capital market	2,6	1,8		6,1	10,5
	External market	9,6	1,6	11,4		22,6
	Total	31,2	9,3	29,6	36,9	107,0

[Statistical annex](#)Chart 2.2.4 – Company debt
By currency and type of hedge[Statistical annex](#)

Notwithstanding the migration between different financing sources, the external debt of non-financial corporations in US dollars remained practically stable in the period (see Section 1.2.5). However, the exchange rate devaluation contributed to the increase in the participation of foreign currency in Brazilian Reais on the companies' liabilities, which summed BRL 1,419 billion in June 2018, or 18.8% of GDP. Nevertheless, the foreign currency debt outstanding that does not have any type of currency protection⁷² is restricted to only 3.0% of GDP, when considering both, financial⁷³ and operational⁷⁴ FX hedges, as currency protection (Chart 2.2.4).

72/ For more details on the methodology, see box Indebtedness of Non-Financial Companies after the 2008 International Crisis in the September 2014 Financial Stability Report (available only in Portuguese).

73/ Long positions in future options and contracts.

74/ Exporter, financial support from the parent company overseas, assets overseas.

2.3 Bilateral margin requirements for over-the-counter derivatives

The global financial crisis between 2007 and 2008 highlighted the need to improve the regulation of over-the-counter (OTC) derivatives markets, aiming both to limit risk-taking and to increase transparency. As a result, the Group of Twenty (G20), of which Brazil is a member, agreed in 2009 to implement a reform agenda covering the OTC derivatives markets, in order to establish international standards to be followed by its member countries. As part of this agenda, the Basel Committee on Banking Supervision (BCBS) and the International Organization of Securities Commissions (IOSCO) published in 2015 the principles of margin requirements for derivative transactions not settled through a central counterparty (CCP).

The publication of Resolution nº. 4,662 of May 25, 2018, by the National Monetary Council (CMN), and Circular nº. 3,902, of May 30, 2018, by the Central Bank of Brazil (BCB) placed Brazil in the group of countries which have implemented the margin requirements according to the G20 agreement.

Bilateral margin requirements consist of the exchange of financial instruments between counterparties of an OTC derivative transaction in order to protect each one of them from losses caused by the inability of the other counterparty to honor its financial obligations related to the transaction. Resolution nº. 4,662, of 2018, defines two types of margins: the variation margin, which is intended to protect the parts of the transaction from their respective current exposures and is determined based on the market value of derivatives contracts; and the initial margin, which is intended to protect the parties of the transaction from risks arising from their respective potential future exposures, as a result of changes in the future prices of the underlying assets of these contracts.

The Resolution nº. 4,662 of 2018 and the Circular nº. 3,902 of 2018 apply to transactions carried out in the over-the-counter derivatives market not settled through a CCP, in which at least one of the parties is an institution licensed by the BCB. However, this does not imply a significant restriction on its scope of application, since almost all the transactions carried out in this market have at least one institution licensed by the BCB as a counterparty.

Due to specific features of the Brazilian derivatives market, in which approximately 80% of derivative transactions are settled through a CCP and only 20% of them are traded on the over-the-counter market and settled without the intermediation of a CCP, the rules issued by the CMN and by BCB seek to preserve the stability of the Brazilian financial system and harmonize national regulation with international standards, while avoiding the imposition of disproportionate costs to a market that presents a low speculative profile. Therefore, the requirements are restricted to transactions between an institution licensed by the BCB and its counterparty (financial or otherwise), where both parties necessarily have a significant volume of transactions in OTC derivatives market.

To enable market participants to adapt their systems and processes to the new framework, Resolution nº. 4,662, of 2018, exempts the transactions carried out until August 31, 2019 from the margin requirements. In addition, the rule exempts transactions carried out between September 1, 2019, and August 31, 2020, from the obligation to post and collect initial margin, provided that at least one of the parties does not exceed the threshold of R\$ 2.25 trillion in aggregate notional amount. However, this Resolution requires the establishment of initial margin for all transactions carried out as of September 1, 2020.

Thus, the regulation of bilateral margin requirements will contribute to the maintenance of the resilience of the Brazilian financial system, providing specific requisites and procedures that seek to protect financial institutions from exposure to counterparty risks in the derivatives market, mitigate the risk of contagion and restricting excessive leverage within the Brazilian financial market.

2.4 Cyber risk and the national simulation exercise on cyber-security incidents

2.4.1 The cyber risk impact on the financial stability

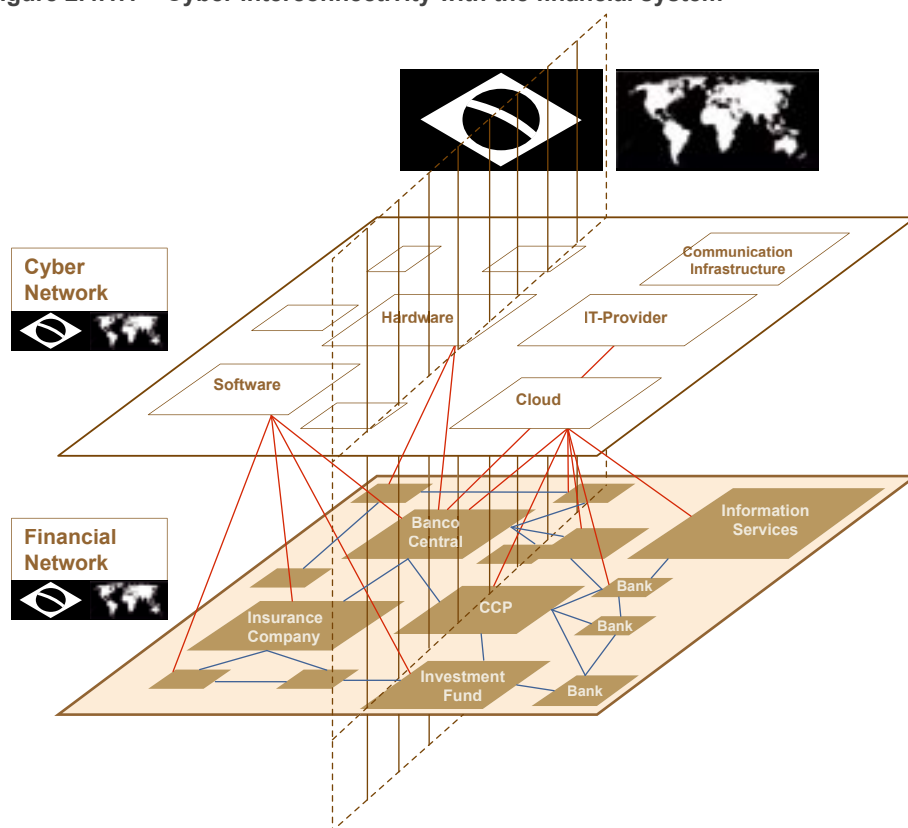
Financial systems are traditionally characterized by large investments in technology of information, aimed at the optimization of operational processes and the implementation of new business models. In recent years, it is noticeable the digital transformation process experienced by financial institutions, culminating in the development of financial services, which are increasingly digital. This technological dependency and inter-connection between systems and processes bring vulnerabilities to financial stability, since the risk of failures or cyber-attacks to these processes can have systemic proportions.

This risk is amplified to the extent that some services providers, such as cloud computing and data processing and storage services, become systemically relevant due to the potential concentration on certain companies. Technological development has created a relationships network between financial institutions, their service providers, hardware and software, both at national and international level, as presented in Figure 2.4.1.1. A cyber-attack targeted at a provider can affect all financial institutions that use its services. This concern is majored by the fact that these services providers are not subject to financial markets regulation.

The unpredictability, the immediate materialization and the growing complexity of cyber-attacks leverage the concern of regulators from different jurisdictions with this risk. Furthermore, due the attacks are not limited to physical borders and economies are increasingly interconnected, it is necessary to enhance articulation among supervisors, both at domestic and international level, aiming at information sharing and the development of joint actions, as well.

Data presented in different forums point to potential relevant losses to financial systems arising from electronic fraud (including cyber-attacks), in line with the discussions held during the Cyber Crimes investigation, held by the Brazilian Congress, and with different incidents targeting at the financial sector around the

Figure 2.4.1.1 – Cyber interconnectivity with the financial system



Source: Thilo Liebig, Deutsche Bundesbank, edited by BCB.

world (for example, attacks on the Bank of Bangladesh and some Mexican financial institutions).

In 2017, the Financial Stability Board (FSB) conducted a survey on existing regulation and supervisory practices⁷⁵. The results showed that concerns regarding cyber risk are present in all surveyed jurisdictions. According to the study, cyber risk is usually handled within either operational or technological risk issues. However, there is a great diversity in terms of regulatory and supervisory frameworks (principles based x more prescriptive) and the disclosure on regulation is more frequent than on supervisory practices.

International organizations took the results of this survey as starting points for the development of several initiatives. Among them, Brazil has active participation in two working groups:

- FSB Cyber Lexicon – this group has recently released for public consultation a document with the consolidation of security and cyber resilience terms in the context of the financial sector; and

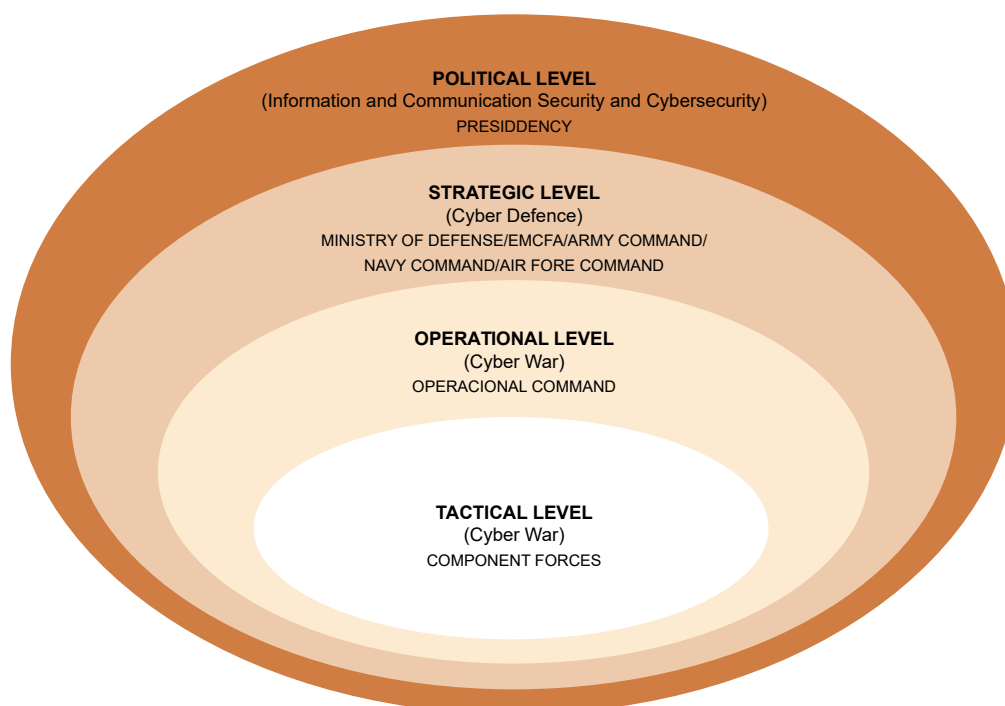
75/ “Stocktake of Publicly Released Cybersecurity Regulations, Guidance and Supervisory Practices”, published on October 13th, 2017 (<http://www.fsb.org/wpcontent/uploads/p131017-2.pdf>).

- BCBS Operational Resilience Group (ORG) – this group is working on the identification and definition of cyber resilience practices in the banking sector.

2.4.2 Managing and mitigating cyber risk in Brazil

Cyber risk is a priority concern of the Brazilian Government. In 2008, the National Strategy for Defense has established two levels on the decision-making process regarding cyber risk: political, in charge of the Presidency Institutional Security Cabinet (GSI); and strategic, in charge of the Ministry of Defense, also responsible for the definition of offensive, defensive and exploratory actions (Figure 2.4.2.1).

Figure 2.4.2.1 – Governmental decision levels on cybersecurity



Source: Cyber Defense Military Doctrine – Ministry of Defense, 2014

In the context of the NFS, issues related to technological risks, including aspects related to information security, have always been part of the BCB agenda.

In 1996, BCB has established a supervisory team specialized on the FI's technological infrastructure supervision, the IT Systems Auditor Team. Since then, the BCB has continuously developed various initiatives related to cyber security, as a response for the accelerated digital transformation observed in the financial system. These initiatives include the improvement of financial crisis management procedures for dealing with cyber-attacks that could affect the financial system; the review of MoU⁷⁶ established with supervisory entities from other jurisdictions, for the inclusion of specific agreements regarding cybersecurity; and the revision of its own supervisory procedures and routines, as well.

Since 2001, BCB coordinates the Subgroup for the NFS Security, which mission is to develop, consolidate and implement security standards for the electronic exchange of information among the NFS entities. Recently, following the evolution of cyber-attacks, BCB has intensified technical contact with other central banks, for experience exchange on the treatment of cyber threats, and started the exchange of information on threats and cyber-attacks among the NFS entities.

In the regulatory spectrum, issues regarding cyber security used to be treated under the operational risk scope. The exponential growth of its relevance in recent years culminated in the publication, in 2018, of Resolution No. 4,658, for financial institutions, and Circular No. 3,909, for payment institutions, with the objective of disciplining the use of important services for the innovation of the NFS technological framework, without despising cybersecurity issues. Both documents require regulated institutions to implement cyber security policy and to report cyber incidents to the supervisor. They have also established minimum requirements to be followed by regulated institutions, whenever hiring services on data processing and storing, and cloud computing.

In addition, the new regulation requires the report to BCB of information regarding the contracts on relevant data processing and storage services and cloud computing. This includes the identification of where those services are physically located, specifying the countries and the

76/ Memorandum of Understanding.

respective regions of each country. This information will allow BCB to map the NFS cloud services network and to identify any existing systemically important dependency on IT services providers.

2.4.3 The Cyber Guardian Exercise

Seeking to contribute to the integration among the government, the private sector and the academia for the improvement of cyberspace protection, the National Command for Cyber Defense (ComDCiber) of the Ministry of Defense developed and conducted, during July 3rd to 6th, the first national simulation exercise on cyber incidents: the Cyber Guardian Exercise.

This exercise was composed of the application of scenarios in a virtual simulator⁷⁷, with the objective of disclosing and disseminating best practices in the treatment of cyber incidents among participants; and tabletop⁷⁸ simulations, to train and integrate the high decision level of the participants with the cyber security national entities.

The incidents comprehended denial-of-service attacks, sabotage, informational leakage, fraudulent modification of systems and web pages, fake news, commitment to integrity of databases, among others.

The participants were encouraged to act in cooperation and integrated, with efforts focused on preventing and resolving incidents. They had to assess and solve not only the direct impacts on its informational assets, but also eventual indirect reputational and/or legal impacts, considering the existing technological and legal constraints. The teams comprised representatives from different hierarchical levels within each organization:

- i) Representatives from decision-making staff (Crisis Committee): top managerial level, from the following areas: IT, communication, legal support and senior management. They were responsible for deliberating actions and measures to address the cyber events;

77/ ComDCiber has developed a virtual simulator tool, the Cyber Operations Simulator (Simoc), in which computing systems used by the participating entities were reproduced.

78/ Tabletop Tests are simulations where participants shall precisely follow the contingency plan instructions, for training purposes and adequacy assessment of the prescribed procedures, as well.

- ii) Representatives from technical-operational staff: experts from the IT security area, responsible for responding to incidents at the virtual simulator; and
- iii) Remote support team: experts from IT security and crisis monitoring areas, located at the headquarters of each participant entity, responsible for responding to the demands for information and executing the actions and measures commanded by their respective Crisis Committee.

In this first exercise, ComDCiber focused on the defense, financial and electronuclear sectors⁷⁹. Other strategic sectors such as telecommunications, water supply and transport, shall also be tested in the future.

In addition to the simulations, a study group formed by representatives from all participating entities were in charge of drafting a proposal for the elaboration of the National Plan for the Treatment and Response to Cybersecurity Events, to be implemented in the future by GSI.

^{79/} This exercise comprehended representatives of the following entities: Ministries of Defence, Justice and Foreign Affairs; Presidency Institutional Security Cabinet (GSI); Navy, Army and Air Force; Federal Government agencies; Central Bank of Brazil; Banco do Brasil; Caixa; Itaú; Bradesco; [B]³; companies from the nuclear sector; academic community and entities linked to the cyber sector.

Appendix

Central Bank of Brazil Management

Acronyms

Central Bank of Brazil Management

Board of Governors

Ilan Goldfajn
Governor

Carlos Viana de Carvalho
Deputy Governor

Carolina de Assis Barros
Deputy Governor

Maurício Costa de Moura
Deputy Governor

Otávio Ribeiro Damaso
Deputy Governor

Paulo Sérgio Neves de Souza
Deputy Governor

Reinaldo Le Grazie
Deputy Governor

Sidnei Corrêa Marques
Deputy Governor

Tiago Couto Berriel
Deputy Governor

Acronyms

ACCP _{Brasil}	Countercyclical Capital Buffer for Brazil (<i>Adicional Contracíclico de Capital Principal relativo ao Brasil</i> , in Portuguese)
B3	Brasil, Bolsa, Balcão
BCB	Central Bank of Brazil (<i>Banco Central do Brasil</i> , in Portuguese)
BCBS	Basel Committee on Banking Supervision
BRL	Brazilian real
CET1	Common Equity Tier I
CHF	Swiss franc
CMN	National Monetary Council
ComDCiber	National Command for Cyber Defense (<i>Comando de Defesa Cibernética</i> , in Portuguese)
Comef	Financial Stability Committee (<i>Comitê de Estabilidade Financeira</i> , in Portuguese)
CSIRT	Computer Security Incident Response Team
EMBI+Br	Emerging Markets Bond Index Plus Brazil
EUR	Euro
FSR	Financial Stability Report
FSS	Financial Stability Survey
FX	Foreign exchange
GBP	Pound sterling
GDP	Gross Domestic Product
GSI	Presidency Institutional Security Cabinet (<i>Gabinete de Segurança Institucional</i> , in Portuguese)
IB	Basel index
IBC-Br	Central Bank Economic Activity Index – Brazil (<i>Índice de Atividade Econômica do Banco Central</i> , in Portuguese)
IL	Short-term liquidity ratio
ILE	Structural liquidity ratio
IPCA	Extended National Consumer Price Index (<i>Índice Nacional de Preços ao Consumidor Amplo</i> , in Portuguese)
IVG-R	Residential Mortgage Collateral Value Index
JPY	Yen
LCR	Liquidity Coverage Ratio
LLP	Loan loss provision
LR	Leverage Ratio
LTV	Loan-to-value
NSFR	Net Stable Funding Ratio
ORG	Operational Resilience Group
OTC	Over-the-counter
ROE	Return on Equity
RWA	Risk-weighted asset

Selic	Brazilian benchmark interest rate, measured within the Sistema Especial de Liquidação e de Custódia (in Portuguese) (Special System for Clearance and Custody)
SFN	Brazilian National Financial System (Sistema Financeiro Nacional, in Portuguese)
Simoc	Cyber Operations Simulator (Simulador de Operações Cibernéticas, in Portuguese)
TPF	Brazilian sovereign domestic bonds
USD	US dollar
VAR	Vector autoregressive

Concepts and methodologies

- a) **Short-term Liquidity Ratio (IL)** – conceptually similar to the LCR, it is the ratio of the stock of liquid assets divided by the net stressed cash flows (estimated total disbursements in the 21 business days under a stress event). 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 meet its net stressed cash flows for the next thirty days. The liquid assets are the sum of high liquid assets, release of reserve requirements (due to the deposits run-off) and supplemental resources.
 - a. High liquid assets – encompass unencumbered Brazilian sovereigns (TPFs), excess margin requirements at exchanges, exchange-traded stocks, investment funds quotas, cash, and excess reserves.
 - b. Reduction of required reserves – the part of the reserve requirement which returns to the institution as a result of the loss of deposits estimated in the stressed cash flows calculation
 - c. Supplemental resources – other options for monetization in the scenario’s time-horizon: Certificates of Deposit (CDB), Receipts of Bank Deposit (RDB), Interbank Deposit (DI), long positions in box strategies, lending positions in repo agreements backed by private securities, less liquid fund quotas.
 - ii. Stressed cash flows – an estimate of the amount of cash outflows in a thirty-day horizon under a stress scenario. The analyses take into account the deposits run-off, the perspectives on early redemptions, the market stress and the contractual outflows.
 - a. Deposits run-off – run-off simulation of bank’s deposits, savings accounts, box strategies, securities issued by the bank, and repo agreements backed by private securities.
 - b. Early redemption – an estimate of the amount necessary to cover for early redemptions of liabilities obtained from the three largest counterparties within the portfolio.
 - c. Market stress – Crisis scenario – an estimate of the amount necessary to cover losses arising from market movements (all risk factors considered for capital calculations) affecting the liquid assets or illiquid positions that may cause a cash outflow. The losses encompass: i) margin calls; ii) settlements of derivatives contracts; iii) losses on marked-to-market values of the liquid assets.

- d. Contractual outflows – Payments due and contractual settlements of derivatives maturing within the scenario's time horizon.

b) Structural Liquidity Ratio (ILE) – It is a ratio of available stable funding – part of the equity and liabilities on which the institution can rely in a one-year horizon – to the required stable funding – part of the assets, including off-the-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 pressures. The calculation methodology is based on the final version of the Net Stable Funding Ratio (NSFR), which will take effect in 2018.

- i. Available stable funding – 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 obtained from retail customers.
- ii. Required stable funding – amount of stable funding needed to finance the long term activities of financial institutions. Therefore, it is calculated taking into account the liquidity and maturity profiles of the institution's assets. The main long-term assets are the credit portfolio maturing in over a year; nonperforming assets; securities with low liquidity or encumbered (e.g. margin requirement in clearings); fixed assets; and 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 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 2014, 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 – 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 leverage ratio (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 BC no 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 BC no 4,553, of January 1st, 2017.

Concepts and methodologies – Capital stress

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 in order 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 as a whole. 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 an 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 no. 4,193 with the redaction given by the Resolution no. 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 no. 4,192, from Mar 1st 2013, and posterior modifications.

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 those information in hands, the capital shortfall of the whole system is calculated.

2.1 Scenarios design

Four macroeconomic scenarios are designed, all of them with six quarters horizon, based on market information and on either a Vector-Autoregressive (VAR) model or repetition of historical changes. The endogenous variables of the VAR model are the economic activity (Economic Activity Index measured by the BCB – IBC-Br), the exchange rate (Brazilian Real vs US Dollar parity), the Brazilian benchmark interest rate (Selic) and inflation rate (measured by the National Index of Price to the Ample Consumer – IPCA – accumulated in twelve months). The exogenous variables are the Brazil's country risk premium (measured by the EMBI+Br spread, calculated by J.P. Morgan Chase) and the 10-yr US Treasury Yield. Unemployment is treated as an external variable of the VAR model. 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 VAR variables: economic activity, interest rates, FX rates and inflation. The GDP – Focus expectation – and the IBC-Br (VAR variable) are perfectly correlated. The Brazil's country risk premium is kept constant over the forecast horizon. On the other hand, the path of the 10-y 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 stressed VAR takes the scenario with the lowest earnings before taxes of the whole financial system, based on four forecasts defined by the VAR model. In each forecast the path of the projection of each endogenous variable (economic activity, exchange rate, interest rate and inflation) is taken individually using a 5% significance level (one-sided at the most adverse direction: low economic activity and interest rates, and high exchange rate and inflation). The other variables are estimated through impulse-responses, which contains the dependency relationships among them, with the objective to keep the consistency of each forecast.

The Structural Break scenario, from June 2018 onwards, is obtained by applying the changes observed in previous periods to the actual values of the scenario variables, using a quarterly rolling window. In each window, the highest changes (either positive or negative) of each macroeconomic variable are obtained. Then the change that causes the worst financial system's performance is chosen. The process is repeated for all the scenario variables. The worst changes of each variable are then chosen, no matter whether they occur in the same period or not.

In the worst historical scenario, repetition of the macroeconomic variables behavior is simulated, through a 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.

The VAR Stressed and Structural Break scenarios assume trajectories for the 10-yr US Treasury Yield according to the baseline scenario designed by the Board of Governors of the Federal Reserve System. The trajectories of EMBI+Br and unemployment are simulated through the repetition of the highest historical variation occurred for each series.

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 are 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 final result.

The BCB changed the methodology used in order 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 No. 3,354, from June, 25th of 2007. However this criteria 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.

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.

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/BRL 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.

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 200% 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 solvency of banks are evaluated.

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 p.p. 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. In order 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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