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FINANCIAL STABILITY REPORT

By Constitutional mandate, *Banco de la República* is responsible for safeguarding price stability of the economy. The proper implementation of this task depends crucially on maintaining financial stability.

Financial stability is understood as a general condition in which the financial system (financial institutions, markets, and infrastructures):

1. Assesses and manages financial risks in such a way that it facilitates the performance of the economy and the efficient allocation of resources;
2. Is capable of autonomously absorbing, dissipating, and mitigating the materialization of the risks that may arise as a result of adverse events.

This *Financial Stability Report* (FSR) presents the Central Bank's appreciation on the recent performance of credit institutions and their debtors, as well as on the main risks and vulnerabilities that could affect the financial stability of the Colombian economy. The FSR is intended to keep both the participants in financial markets and the general public informed, besides promoting public debate on the trends and risks related to the financial system. The results herein presented also serve as a basis for the monetary authority to make decisions that promote financial stability in the general context of the constitutional objectives of price and macroeconomic stability.

This FSR is complemented by the Payment Systems Report, published annually by *Banco de la República*, which reports on the performance of the financial infrastructures of the Colombian economy.

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Glossary

API: Application Program Interface
AT1C: Additional Tier 1 Capital
BCBS: Basel Committee on Banking Supervision
BDBR: oard of Directors of *Banco de la República*
BF: Brokerage Firms
BIS: Bank of International Settlements
bp: Basic Points
CDT: Term Deposit
CET1: Common Equity Tier 1 Capital
CI: Credit Institutions
CIF: Collective Investment Funds
CIR: Inter-sectoral Resolution Commission
CMA: Competition and Market Authority
COP: Colombian Pesos
CPI: Consumer Price Index
CSD: Central Security Depository
DD: Distance to Default
DSR: Debt-Service Ratio
EUR: Euros
FDI: Foreign Direct Investment
FED: Federal Reserve of the United States
FNA: National Savings Fund
FSB: Financial Stability Board
FTD: Fixed-Term Deposit Effective Rate
GDP: Gross Domestic Product
IBR: Interbank Reference Rate
IC: Credit Intermediation
ICE: Indicator of Consolidated Exposure
IEFIC: Debt Service and Financial Education Survey
IFRS: International Financial Reporting Standard
IIE: Indicator of Individual Exposure
IMC: Foreign Exchange Market Intermediaries
IMC: Investment Management Companies
IMF: International Monetary Fund
IPS: Health Service Providers
LIH: Low Income Housing
LRI: Liquidity Risk Indicator
LSRR: Liabilities Subject to Reserve Requirements
MADR: Ministry of Agriculture and Rural Development
MER: Market Exchange Rate
MT: Maturity Transformation
NAFTA: North American Free-Trade Agreement
NBFI: Non-Banking Financial Institutions
NIM: Net Interest Margin
NLR: Net Liquidity Requirements
NPL: Non-Performing Loans
OB: Open Banking
PEF: Private Equity Funds
PFM: Pension and Severance Fund Managers
PILA: Integrated Template for Liquidation of Contributions
PUC: Single Accounting Plan
QRI: Quality Risk Indicator
ROA: Return on Assets
ROE: Return on Equity
IRPR: Indicator of Risk Perception by Rating
RUNEOL: Single National Registry of Payroll Deductible Loan Operators
RWA: Risk Weighted Assets
SB: Shadow Banking
SES: Superintendence of Solidary Economies
SFC: Office of the Financial Superintendent of Colombia
SMES: Small and Medium-Sized Enterprises
SS: Superintendence of Corporate Affairs
SYSMO: Systemic Stress Model
T2C: Tier 2 Capital
TC: Trust Companies
TES: Colombian Public Debt Bonds
USD: US dollar
UVR: Real Value Unit
VAR: Vector Auto-Regression Model
WATM: Weighted Average Term to Maturity

Executive Summary and Risk Map

In late 2018, the Colombian financial system completed a long process of adjusting to the shocks that had been experienced by the economy since mid-2014. This process was characterized by the materialization of credit risk (in the form of surges in the past-due and risky loan portfolios), low profitability (caused by greater outlays on loan-loss provisions), and low growth of the loan portfolio and of the credit establishments' financing sources. During this adjustment period, the financial institutions' indicators of capital adequacy and liquidity remained persistently sound.

With progress in the adjustment process and the favorable change in the macroeconomic environment, the growth rates of the risky and past-due loan portfolios are close to their historical averages at the same time as the results of *Banco de la República*'s survey on credit situation point to a recovery in the growth of the loan portfolio. These favorable trends are reflected on the risk maps in Graphs A and B[1] where the risk and credit cycle variables have gradually abandoned the redder and blue tones respectively (although less vigorously in the case of the commercial portfolio). Even though the profitability indicators continue to remain in the reddish shades, improvements have begun to be seen in the last few months due to the slower growth rate of expenditures on loan-loss provisions.

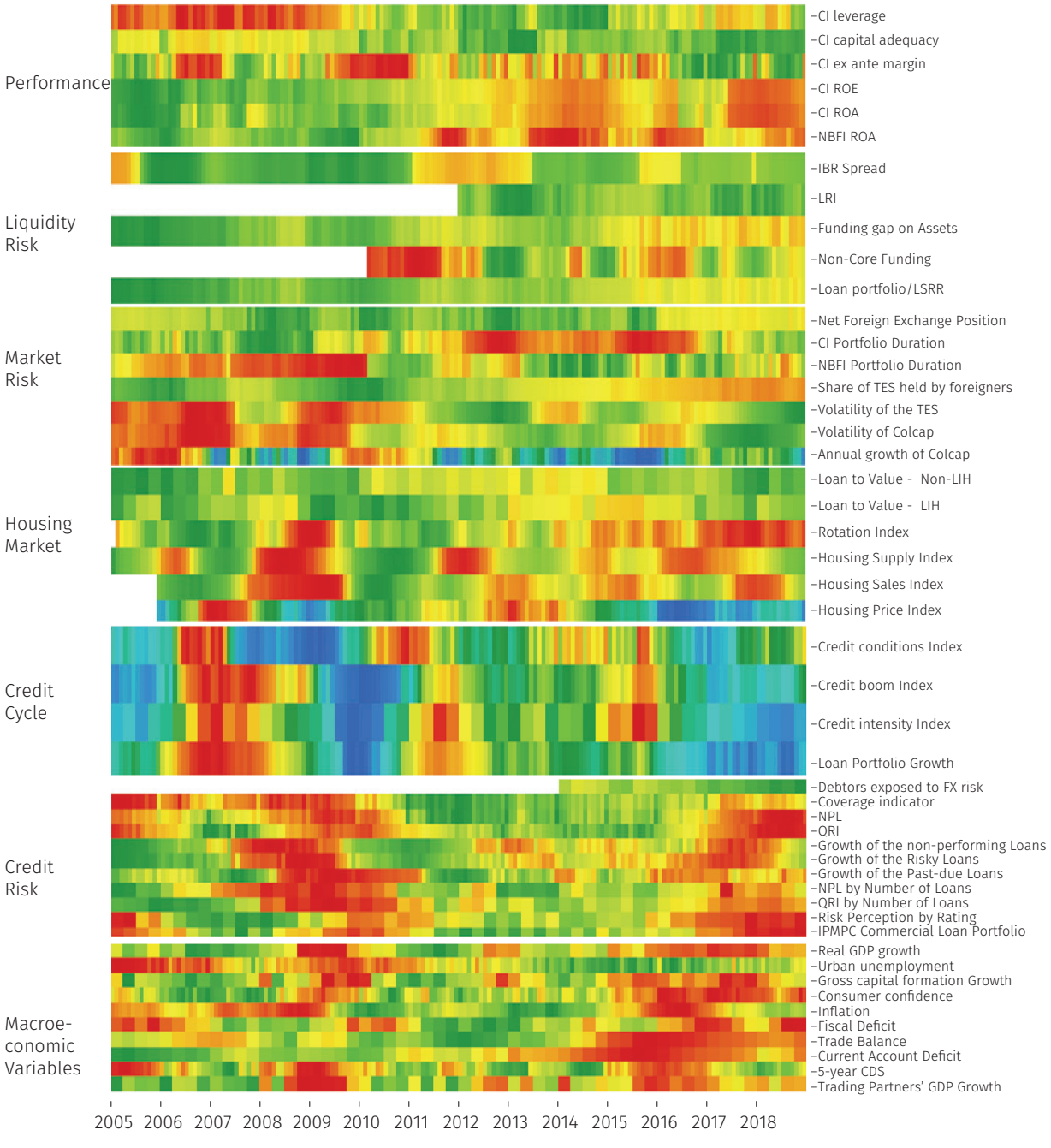
In this context, the Colombian economy has a resilient financial system and has made progress in prudent regulation that makes it unlikely that credit conditions will become a source of macroeconomic disruption. In the medium term, the expected expansion of the deficit in the current account of the Colombian economy[2] and the latent risk of lower growth for some of our trading partners[3] represent vulnerabilities that, in the event of negative shocks, could affect the stability of the financial system. The foregoing could occur through a deterioration in the quality of the loan portfolio in a context of lower economic growth as a result of either a decrease in overall

1 The technical details on the reading of, construction of, and variables used on the map are presented in Box 1 of the September 2017 Financial Stability Report.

2 In this regard, the deficits in the fiscal and external accounts of the economy are manifested in shades of red on the risk map.

3 See the April 2019 Global Financial Stability Report of the International Monetary Fund.

Graph A
Risk Heatmap of the Colombian Financial System

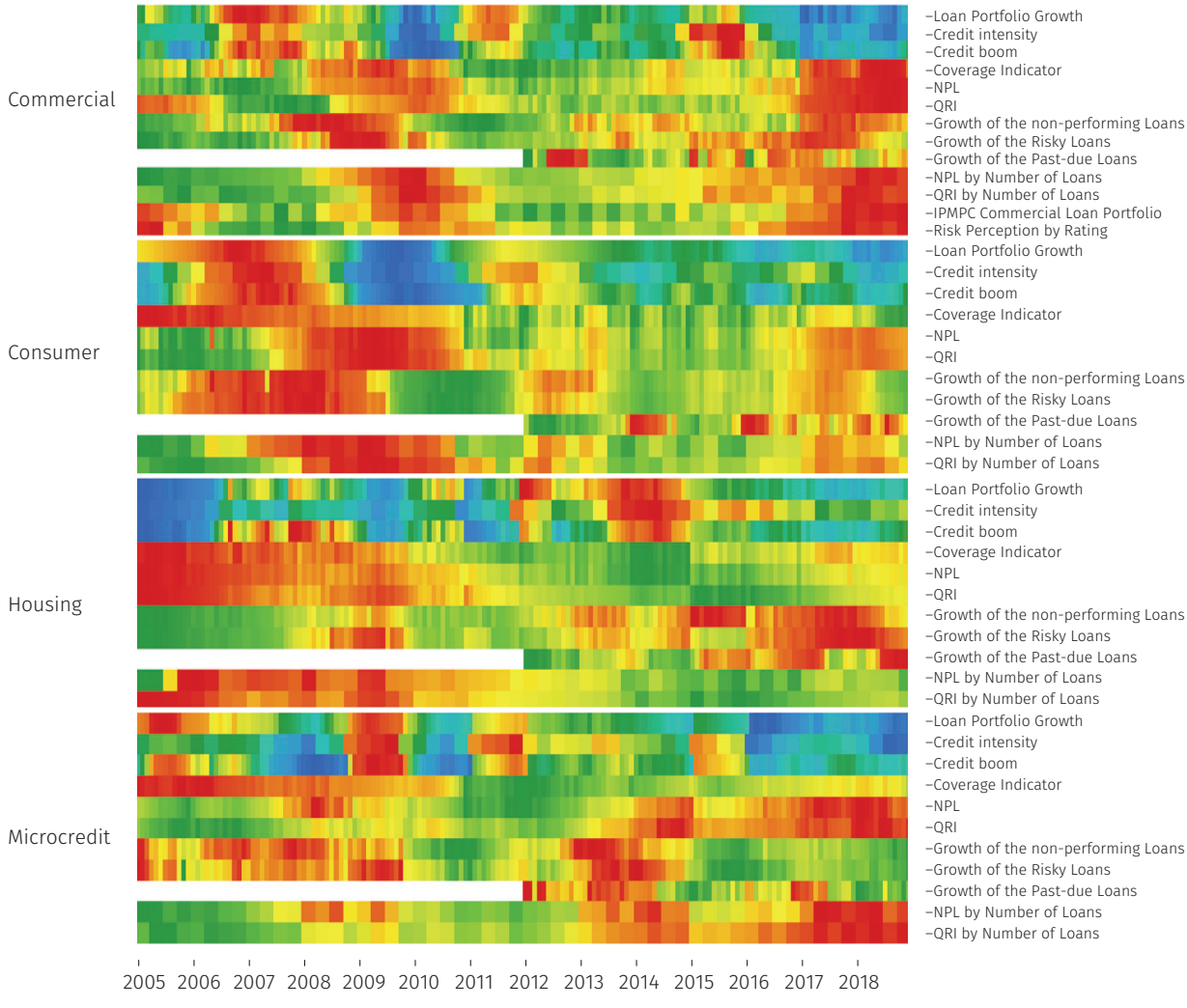


Source: Superintendencia Financiera de Colombia (hereinafter Office of the Financial Superintendent of Colombia), DANE, Fedesarrollo, Bloomberg, and *Banco de la República*, calculations by *Banco de la República*.

growth or of difficulties in foreign financing that could negatively affect aggregate demand.

On the domestic front, credit risk is continuing to materialize in economic sectors such as construction and agriculture while, in the housing loan portfolio, its intensity has declined. With regard to market risk, foreign investors continued to increase their holdings of public debt securities during the second half of 2018 at a rate similar to the one seen during the same period the previous year. At the same time, these investors reduced their positions in the local stock market rather severely

Graph B
Risk Heatmap for Credit



Source: Office of the Financial Superintendent of Colombia, DANE, Fedesarrollo, Bloomberg, and *Banco de la República*, calculations by *Banco de la República*.

during the second half of 2018, and this may have contributed to the depreciation of the Colcap index during the same period (in any case, up to this point in 2019, the index has recovered to the level observed midway of the previous year). These trends were reflected in a high volatility of stock prices and appreciations of the medium- and long-term public debt securities.

In view of the vulnerabilities identified and in order to adopt a prospective approach, this report presents a stress test that evaluates the resilience of the credit establishments in the event of an extreme hypothetical scenario. The scenario includes a slowdown in the Colombian economy during the remainder of 2019 that becomes more accentuated during 2020, difficulties in the area of international financing, a greater manifestation of credit risk in vulnerable sectors, and foreign investors withdrawing from the local public debt market. The results suggest that the aggregate indicators of overall and core capital adequacy will probably remain

at levels exceeding the regulatory limits during the horizon of the scenario in spite of the potential declines in profitability and volume of the loan portfolio.

This edition of the Report includes, for the first time, a box written by the Office of the Financial Superintendent of Colombia, which deals with the institution's role in the reversal of the recent deterioration in the loan portfolio in Colombia. The progress in the regulation and supervision of the Colombian financial system is shown in this box and complements *Banco de la República*'s monitoring work and the risk analysis in this *Report*.

Banco de la República, in compliance with its constitutional objectives, will continue to monitor the situation of the financial institutions and make those decisions that will ensure levels of inflation and growth that are consistent with macroeconomic stability and long-term economic development. The analysis of the vulnerabilities presented in this Report constitutes a call to participants in the financial markets to make sure that the risks that they find themselves exposed to are assessed and managed appropriately and prudently.

Juan José Echavarría
Governor

01

Macroeconomic Environment

With the exception of the United States, major economies suffered slowdowns in 2018. For the next two years, lower global economic growth is expected, a situation that, up to this point in 2019, has begun to be reflected in a deterioration of the leading indicators of activity.

In the year 2018, the United States reached a 2.9% growth level and thus, registered its highest expansion in the last three years. The above was accompanied by a robust labor market given the strong job creation and the lowest unemployment rates that have been seen in eighteen years. During the same period, inflation, in turn, was close to the 2% target for both the general price level and the indicator excluding food and energy. This performance led the Federal Open Market Committee of the Federal Reserve (Fed) to increase the range of the federal fund rates at their meetings in March, June, September, and December 2018.

On the other hand, the euro zone continued to see slowdowns in recent quarters which led to its lowest annual growth rate since 2014 (1.8%). With respect to inflation, there have been declines in both the total and the core inflation indicators, which reached the levels registered towards the end of 2017. At the same time, the Governing Council of the European Central Bank ended its asset purchase program in December 2018. In spite of the above, they will continue reinvesting the capital of the securities acquired through this program for an indefinite period depending on the liquidity conditions that the area requires.

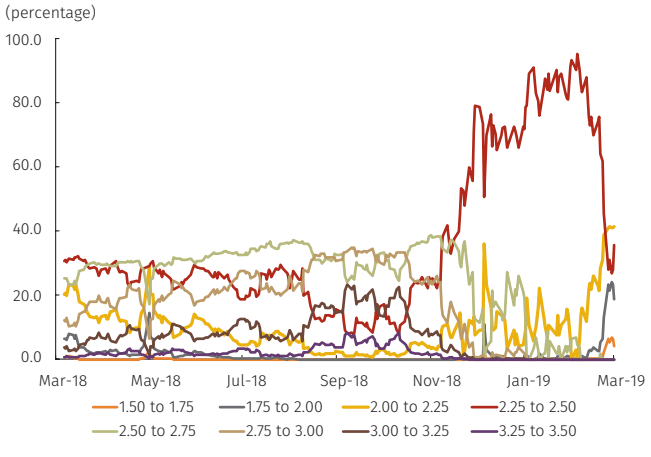
China registered its lowest growth since March 2009 as it showed a 6.6% expansion in 2018. This performance had been anticipated due to two factors: a change in its economic policy that is intended to develop the domestic market in order to generate less dependence on foreign demand and a negative impact caused by the trade war with the United States. In addition, restrictive monetary conditions were imposed that

Table 1.1
Growth prospects for the major economies

	2017[a/]	2018[a/]	2019[b/]	2020[b/]
United States	2.2	2.9	2.3	1.9
Euro zone	2.4	1.8	1.3	1.5
China	6.8	6.6	6.3	6.1

a/ Observed Growth
b/ Expectations for growth
Source: International Monetary Fund.

Graph 1.1
Probability by ranges for the Fed benchmark rate as of December 2019



Note: At the time this Report was written, the Fed rate stood within the range of 2.25% to 2.50%.
Source: CME Group.

were implemented in order to decrease financial leverage. This imposes an additional challenge for their growth outlook.

In addition to the challenging outlook that the major economies faced in 2018, the International Monetary Fund (IMF) forecasts an increase in the downward risks for 2019. As can be seen in Table 1.1, the growth forecasts of the most recent *World Economic Outlook* show an expectation of a downturn for the previously mentioned economies.

Specifically, for the United States, the positive effect of the reduction in corporate taxes will probably decline, the negative effects of monetary normalization are likely to begin to appear, and impacts resulting from the trade war with China and the closing of the Federal government during the first few months of 2019 could occur. These factors are already resulting in a deterioration in the indicators of job creation, lower inflation, and in a rise in the probability of a decrease in the interest rates on the part of the Fed for the remainder of 2019 (Graph 1.1). In spite of the foregoing, the greatest impacts are expected in 2020 when the growth is likely to reach a level of 1.9%.

Europe, in turn, will probably continue to show a weak performance over the next two years. Consumer confidence remains relatively low, inflation has had setbacks in recent months, and manufacturing surveys have shown deterioration. In addition, the difficulties in reaching an agreement regarding the withdrawal of the United Kingdom from the European Union could cause greater economic uncertainty. Last of all, the slowdown in China will probably continue as a result of the trade war with the United States, lower foreign demand, and their efforts to deleverage the corporate sector.

The Latin American economies, in turn, showed upswings in 2018, except for Argentina and Ecuador. In general, higher growth is expected for the next two years.

In contrast, the Latin American economies showed a better performance in 2018 with the exception of Argentina, where the adjustment required as a result of the expansion of its fiscal and foreign deficits implied a sharp slowdown, and Ecuador, where the fiscal stimulus in 2017 had a minimal effect, and there was a lower production of crude oil. The growth of Peru and Chile, where private investment in mining spurred expansions of above 4%, stands out. In the aggregate, an

upswing is expected for the region over the next two years driven mainly by Colombia, Brazil, and Argentina (Table 1.2).

Colombia exhibited a 2.7% growth rate in 2018. Growth was registered for all the branches of activity with the exception of mining and quarrying.

Table 1.2
Growth prospects for Latin American Economies

	2017[a/]	2018[a/]	2019[b/]	2020[b/]
Argentina	2.7	-2.5	-1.2	2.2
Brazil	1.1	1.1	2.1	2.5
Chile	1.3	4.0	3.4	3.2
Ecuador	2.4	1.1	-0.5	0.2
Mexico	2.1	2.0	1.6	1.9
Peru	2.5	4.0	3.9	4.0
Colombia	1.4	2.7	3.5	3.6

a/ Observed Growth
b/ Expectations for growth.
Source: International Monetary Fund.

In the case of Colombia, real annual growth of 2.7% was registered in 2018, which is higher than the 1.4% seen a year ago (Table 1.3). When sector performance is evaluated, it is evident that the branch of mining and quarrying was the most sluggish one since it was the only one with a downturn. In spite of the above, it was the one that had the greatest surge since it grew 5 percentage points (pp) faster than it did the previous year. The greatest expansion was seen in professional, scientific, administrative, and support occupations as well as in public administration, defense, education, and social services. The branches of manufacturing and construction showed growth after having shrunk over the course of 2017. The forecasts calculated by the technical staff at *Banco de la República* point to an economic expansion of 3.5% in 2019. This possible surge is based on the expectation of more domestic demand and investment, which is likely to offset the anticipated deterioration in the country's terms of trade and foreign demand.[1]

Greater sluggishness in the trading partners' economy could affect growth, capital flows, and Colombia's terms of trade. The above is relevant given the deficits in the current and fiscal accounts of the local economy.

Colombia's growth recovery has been accompanied by a slowdown in credit risk indicators which, in turn, has translated into a reduction in the additional probability of low growth coming from financial weaknesses[2]

1 See the minutes for the March 22, 2019 meeting of the Board of Directors of *Banco de la República.*

2 For more information on this indicator, see Box 1 in this *report.*

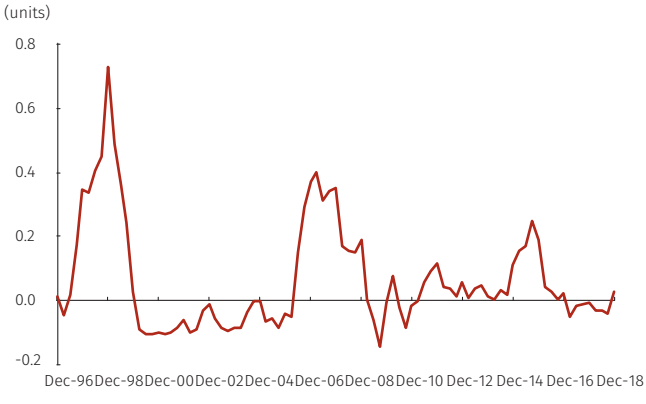
Table 1.3
GDP Annual Real Growth by Economic Activity Sectors: seasonally adjusted series
(percentage)

	2017	2018
Agricultural, forestry, hunting and fishing	5.5	2.0
Mining and quarrying	-5.7	-0.8
Manufacturing industry	-1.8	2.0
Electricity, gas and water	2.9	2.7
Construction	-2.0	0.3
Trade, repairs, restaurants and hotels	1.9	3.1
Information and communication	-0.2	3.1
Financial and insurance	5.4	3.1
Real estate activities	3.1	2.0
Professional, scientific, administrative and support	1.3	5.0
Public administration, defense, education and social services	3.5	4.1
Art, entertainment and other services	2.2	1.4
Subtotal added-value	1.4	2.5
Taxes minus subventions	1.1	2.6
GDP	1.4	2.7

Source: DANE (National Bureau of Statistics).

(Graph 1.2). Notwithstanding the above, the expected expansion in the current account deficit (which could be higher when it is adjusted for the real exchange rate and terms of trade) added to the expectation of lower growth for our trading partners represents a potential vulnerability for the local financial system (Graph 1.3).

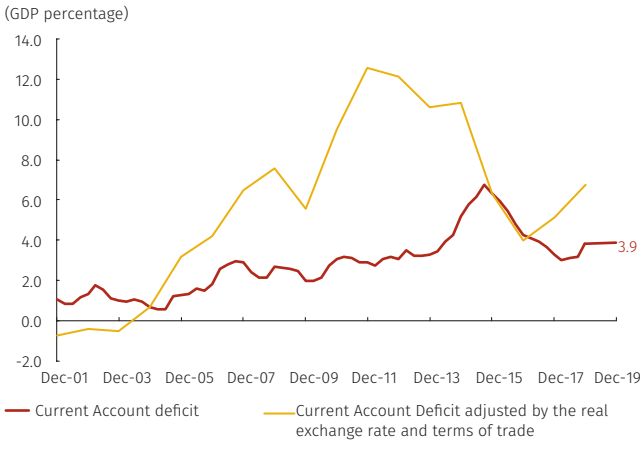
Graph 1.2
"Extra" probability of low growth coming from financial fragilities



Source: *Banco de la República.*

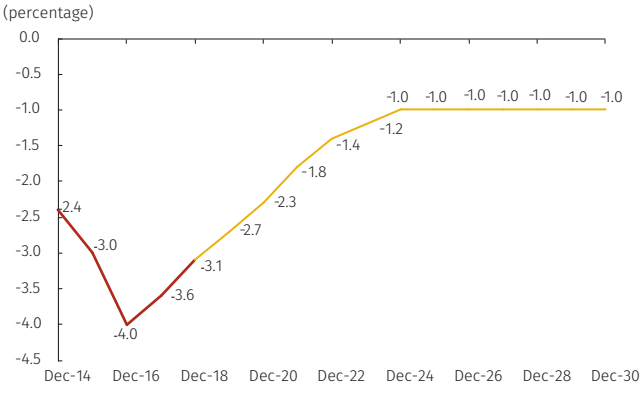
In this regard, two mutually exclusive risks that could lead to a slower pace of growth in the medium term were identified. On the one hand, the lower external growth could affect some tradeable branches of the economy and have a negative impact on the terms of trade due to lower demand. On the other, a rise in risk aversion could lead to difficulties in financing from abroad that might result in a reduction in aggregate demand. In its most recent *Global Financial Stability Report*, the IMF recommends holding appropriate levels of foreign reserves, macroprudential policies, and fiscal buffers that are enough to face a stressed situation associated with the latter risk. In spite of the fact that Colombia meets the first two recommendations, the last one would be difficult to apply locally given the commitments arising from compliance with the trajectory imposed by the fiscal rule in the coming years (Graph 1.4).

Graph 1.3
Current Account deficit



Note: Data for 2019 corresponds to the baseline forecast scenario of the current account deficit from the December 2018 Inflation Report.
Source: *Banco de la República.*

Graph 1.4
Total Fiscal Balance Permitted by the CNG According to the Fiscal Rule Advisory Committee
(percent of GDP)



Source: The Fiscal Rule Advisory Committee (Minutes 011).

Given the above, it becomes relevant to study the resilience of the Colombian financial system in an environment in which these risk factors materialize. That is why this *Report* presents a stress test that calculates the potential impact of a hypothetical scenario that includes a more restrictive external environment (that involves a capital outflow) and lower economic growth over the medium term for our trading partners – conditions that would result in a slowdown on the domestic level and the lower creditworthiness of some economic sectors. It likewise seeks to measure the appearance of a set of risks for the banking system as a result of that shock. The usefulness of the exercise lies in providing an estimate of the potential losses that could be seen in this scenario and reveal the possible transmission channels through which the vulnerabilities identified could end up affecting financial stability.

The results show a drop in the aggregate capital adequacy of credit establishments that remains above the regulatory minimum at the end of the test. This is accompanied by a reduction in the levels of profitability and the strength of the portfolio. That underscores the need to continue carefully monitoring both the debtors' and institutions' financial situations as well as the changing conditions in the macroeconomic environment. These results are obtained from a hypothetical scenario and the use of a set of restrictive assumptions. It is to be expected, therefore, that under shocks that are smaller in magnitude, or using weaker assumptions, the impact on financial stability will presumably be lower.

Box 1
Indicator of Additional Probability of Recession

Santiago Gamba
Daniel Osorio*

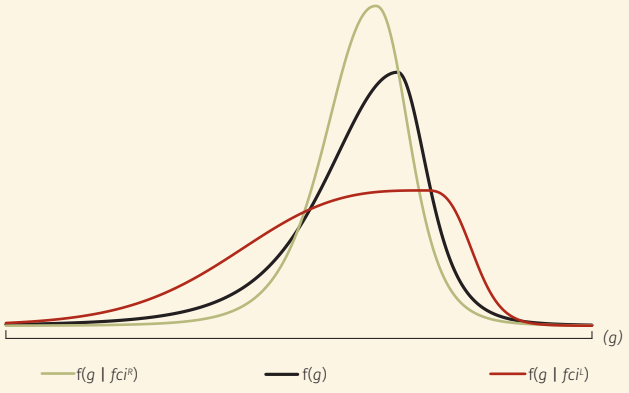
Taking as a starting point the measurement of GDP-at-risk, which was introduced in Box 1 of the *Financial Stability Report* of the first half of 2018, and following the work of Adrian et al. (2017), this box presents the indicator of additional probability of recession (IAPR). The IAPR seeks to measure the magnitude of the vulnerabilities in terms of economic growth stemming from financial conditions by studying the difference between the left tails of the non-conditional distribution and the conditional distribution of the GDP on financial conditions. This difference is interpreted as the "additional" probability of recession that current financial conditions cause to the economy.

1. GDP-at-risk: the distribution of the GDP and the financial conditions

The results of calculating the measurement of GDP-at-risk are illustrated in Graph B1.1 where $f_t(g)$ is the non-conditional density function of future growth at moment t; $f_t(g|fci_t^L)$ is the conditional density function of future growth in which the financial conditions in are "lax" or in a "credit boom," and $f_t(g|fci_t^R)$ is the conditional density function of future growth in which the financial conditions in are "restrictive" or in a "credit squeeze."[1]

Starting from the non-conditional distribution of GDP growth, when restrictive financial conditions are controlled for, the distribution is seen to exhibit less variance and shifts slightly to the left. The most drastic change is found when it is conditional upon lax financial conditions. In this case, the distribution becomes skewed to the left, its variance rises, and it moves slightly to the right. This, as a result, generates a heavier left tail. In summary, financial conditions are positively associated with the probability that an economic recession will occur in the future.

Graph B1.1
Example of Estimated Distribution of GDP Growth in Colombia



Source: calculations by *Banco de la República*.

2. Contribution of the financial conditions to the probability of recession

Using the distributions of growth over time, $L_t^D(h)$ is defined as the indicator of additional probability of recession h periods ahead (downside entropy, according to Adrian et al., 2017) as follows:

$$L_t^D(h) = -\int_{-\infty}^{F_{t+h}^{-1}(0,5\,|fci_t)} [\log f_{t+h}(g) - \log f_{t+h}(g|fci_{t+h})] f_{t+h}(g|fci_{t+h})\, dg$$

Where $f_t(g|fci_t)$ corresponds to the conditional density of future growth with respect to financial conditions in (as a continuous variable) and $F_t^{-1}(g|fci_t)$ represents the inverse conditional distribution function of future growth with respect to the same variable. $L_t^D(h)$ seeks to measure to what extent financial conditions suggest a greater probability that a recession will occur in comparison to what is estimated when financial conditions are not taken into account. This indicator will hereinafter be referred to as IAPR. The IAPR follows a trend that is similar to the one presented by the area between the left tail of the conditional distribution and the left tail of the non-conditional distribution (Graph B1.2). Thus, when financial conditions are relaxed, this area tends to increase, which indicates that the probability of a recession rises due to laxer financial conditions.

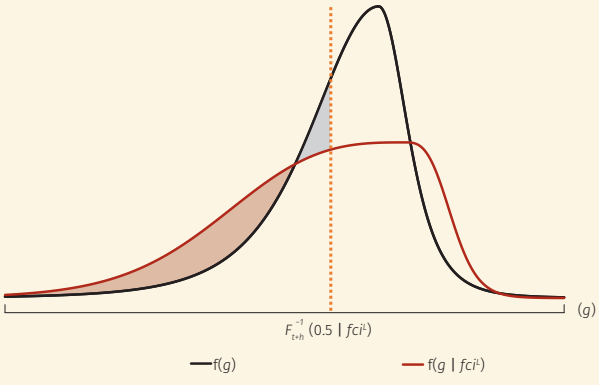
Graph B1.3 shows the evolution of IAPR over time with a horizon of one year. In recent history, this indicator has presented its highest values during periods prior to the times of greater financial turbulence. First of all, between June 1997 and December 1998, while the growth rate of the loan

* The authors are part of the Financial Stability Department in B*anco de la República*. The opinions expressed here are the sole responsibility of the authors and do not imply any commitment on the part of *Banco de la República* or its Board of Directors.

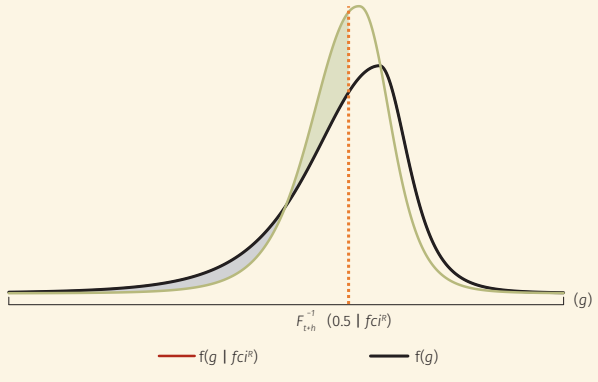
1 For the construction of this indicator, the financial conditions are measured with the credit boom indicator. In this respect, financial conditions, in practice, are not binary between "lax" and "restrictive" but rather correspond to a continuous variable.

Graph B1.2
Graphic Estimate of the IAPR

A. Facing lax financial conditions



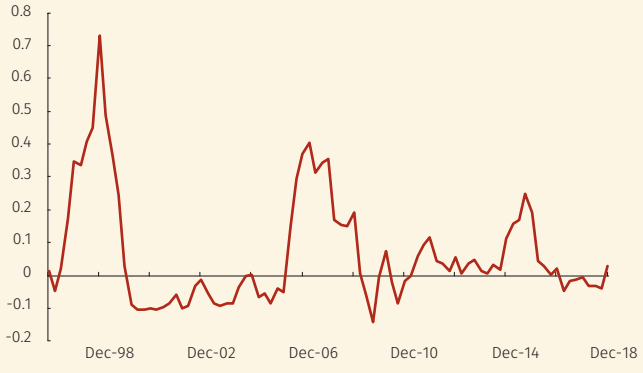
B. Facing restrictive financial conditions



Source: DANE, calculations by *Banco de la República*.

portfolio increased, the IAPR surged in anticipation of the financial crisis of the late 1990s. Second, between June 2006 and March 2007 the IAPR pointed to a rise in the probability of low future economic growth, an event that occurred subsequently in the wake of the materialization of credit risk that had accumulated and the global financial crisis. Finally, over the last few periods, the IAPR has remained at low levels in consonance with the weak growth of credit and the disappearance of large financial imbalances in credit markets.

Graph B1.3
IAPR



Source: calculations by *Banco de la República*.

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Koenker, R.; Hallock, K. (2001). "Quantile Regression", *Journal of Economic Perspectives*, vol. 15, no. 4, pp. 143-156.

Box 2
Aggregate Vulnerability Indicator

Angélica Lizarazo
Santiago Gamba*

A new tool that will contribute to the monitoring of the vulnerabilities in the Colombian financial system is introduced in this box. The *overall vulnerability index* (OVI) seeks to identify risk accumulation phases that could contribute to the amplification of economic and financial shocks. Following the methodology proposed by Aikman et al. (2017) and Fisher and Rachel (2017), these types of indicators summarize a broad set of variables by classifying them into different risk categories. This kind of approach recognizes the fact that no variable on its own is sufficient to determine periods of accumulating vulnerabilities in a complex and changing financial system. Furthermore, even though the analysis offers a single indicator of vulnerability, the methodology allows the sectors that constitute the source of vulnerability at each point in time to be identified.

1. Methodology

The 48 indicators that were used to build the OVI and the hierarchical organization used to add the variables are presented in Diagram B2.1. The OVI is composed of vulnerabilities that bring together the accumulation of risks from pressure from abroad, imbalances in the indebtedness of the financial, non-financial, and sovereign sectors, and pressure from financial market valuation. Each vulnerability, in turn, consists of different components associated with economic sectors or financial risks. The OVI is calculated in three stages. In the first stage, the individual indicators in the components are added. This makes it possible to control the weight that each of the sectors of the economy has in the analysis regardless of the number of indicators available for each sector. In the second stage, the components in the vulnerabilities which are a key element for providing clarity regarding the sectors that determine the economy's risk profile during each period are added. The third stage is to construct the OVI based on the vulnerabilities and thus generate an indicator with the highest level of aggregation of the economy's weaknesses.

Prior to each stage of aggregation, the following treatment is done. In order to extract the signals that are targeted, the trend component that the variables may have is eliminated. To make the indicators comparable, the frequency of the information is homogenized by introducing the lower frequency series, and then, the series are standardized and restated using quintiles based on their historical empirical distribution. Thus, the range of the variable is between zero and one. In addition, if the variables are not available for the entire horizon of analysis, Fisher and Rachel (2017) recommend assuming an average value or the first value seen in the series for the information missing in the first few periods while for the information missing from the later periods, the variable is assumed to take on the value of the latest data seen.

2. Results

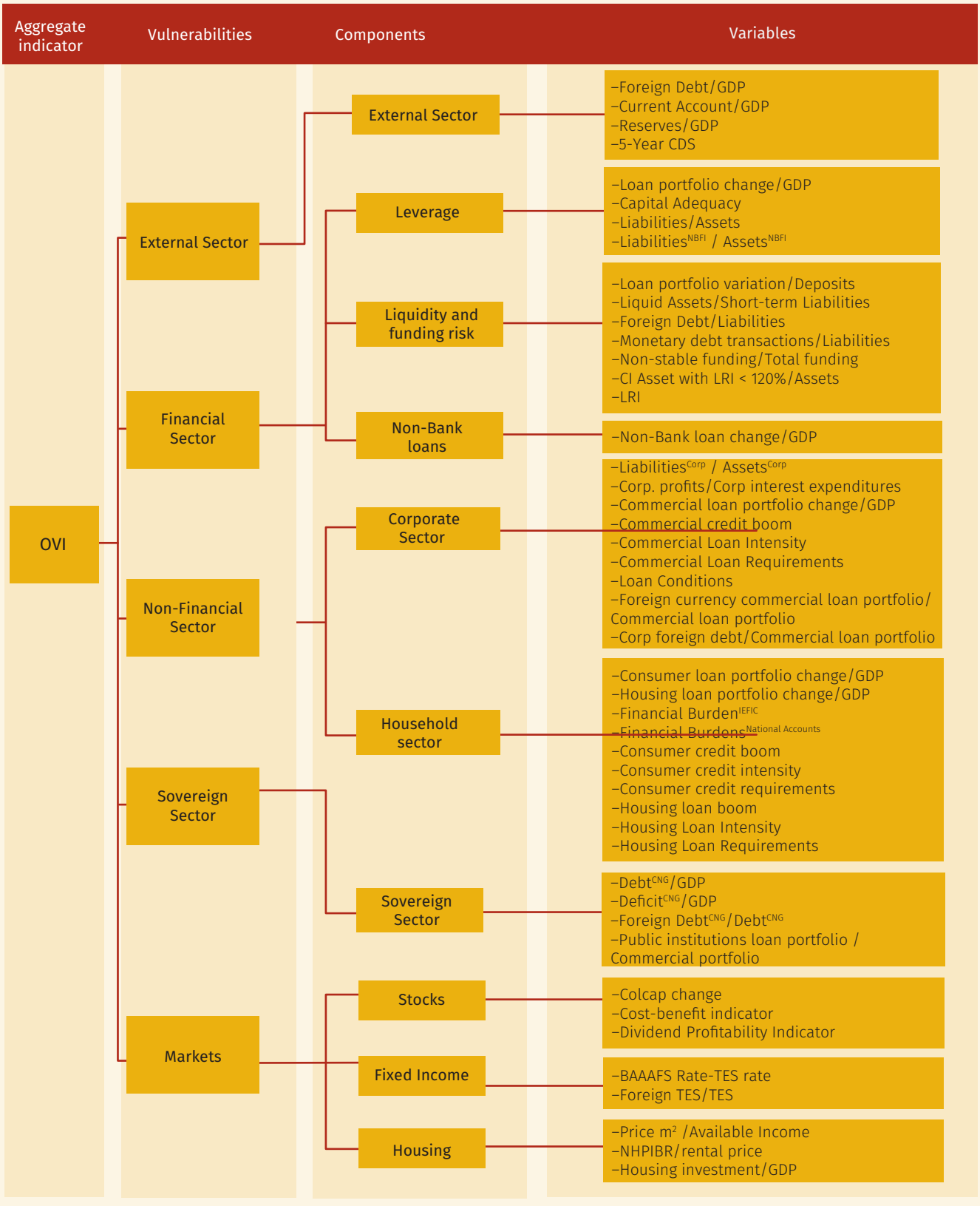
Graph B2.1 shows the results of the OVI and its breakdown for a horizon of analysis between January 1995 and December 2018. The analysis identifies four periods of high vulnerability: 1) November 1997 to December 1998, the period prior to the financial crisis at the end of the century, 2) October 2001 to May 2003, a stage that coincides with the crisis in local public debt market, 3) June 2006 to January 2007, the time when a credit boom was seen in the commercial and consumer loan portfolios, and 4) January 2015 to December 2016, the period after the fall of crude oil prices that was registered in the last quarter of 2014.

The indicator for each of the vulnerabilities and their components is presented in Graph B2.2. This analysis makes it possible to examine the sectors that drive the risk accumulation in the economy for the previously mentioned periods of vulnerability as shown below.

- Period (i) is characterized by imbalances in the foreign, financial, and non-financial sectors that were associated with the worst historical levels of perception of country risk and foreign reserves and high levels of indebtedness in companies, households, and the financial sector. These vulnerabilities were part of the conditions that led to the financial crisis in the late 90s.
- Period (ii) presents growing vulnerabilities in the sovereign sector and higher valuation pressure on the financial and housing markets. The above coincided with a high degree of uncertainty in the region due to the political environment in Brazil, the TES market crisis, and reductions in the country's credit rating which generated significant losses for financial institutions as a result of the valuation of these securities.
- Period (iii) presents high levels of leverage in financial and non-financial sectors. In spite of the fact that improvements in the foreign and sovereign sectors were registered during this period of time, the aggregate indicator reached high levels due to the growth spurt in the loan portfolio and the CIs' exposure to those assets.

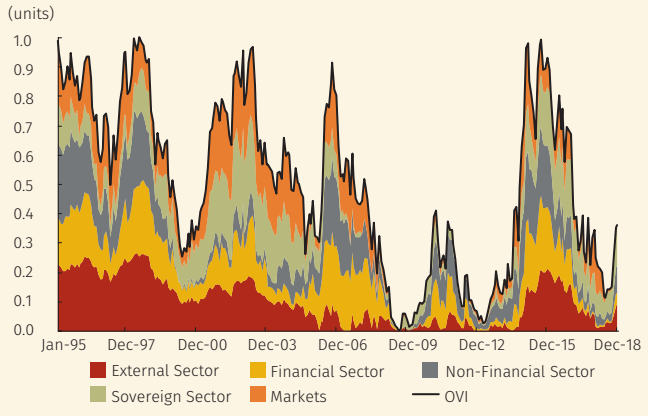
* The authors are part of the Financial Stability Department in *Banco de la República*. The opinions expressed here are the sole responsibility of the authors and do not imply any commitment on the part of *Banco de la República* or its Board of Directors.

Diagram B2.1
Overall Vulnerability Index



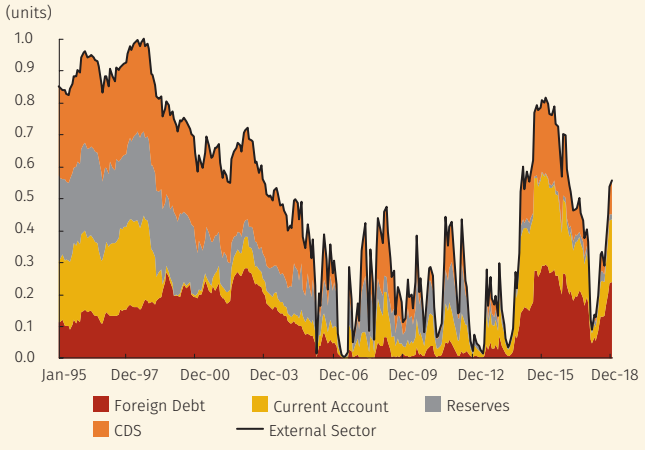
Note: FC: foreign currency, Corp: companies in the private corporate sector, CNG: Central National Government, IEFIC: Survey of Education and Financial Burden INHPBR: Index of New Housing Prices calculated by *Banco de la República*, BAAAFS: yield curve for banks with AAA rating at a simple, fixed-rate, Credit boom: sum of the cyclical component of the per capita loan portfolio and the cyclical component of the annual growth of the per capita loan portfolio, Credit intensity: quarterly growth of the loan portfolio to the quarterly GDP, The financial variables without superscript refer to information from CIs.
Source: authors' calculations.

Graph B2.1
OVI



Sources: Office of the Financial Superintendent of Colombia, DANE, Bloomberg, Ministry of the Treasury, and *Banco de la República*, calculations by *Banco de la República*.

Graph B2.2
Indicator of Vulnerability of the External Sector

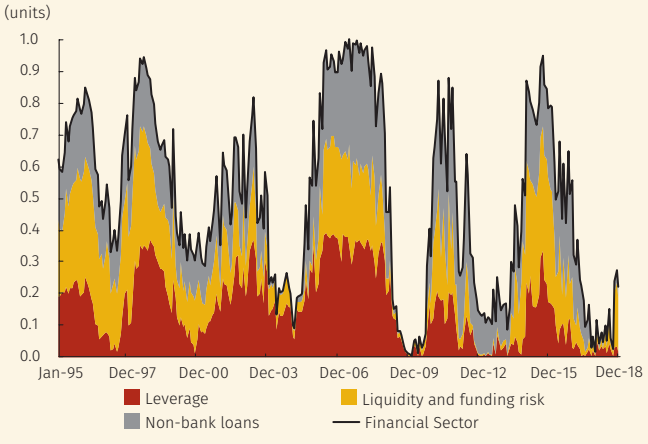


Sources: Office of the Financial Superintendent of Colombia, DANE, Bloomberg, Ministry of the Treasury, and *Banco de la República*, calculations by *Banco de la República*.

In the months that followed, the accumulated credit risk materialized at the same time that the effects of the global financial crisis, which generated a downturn in the Colombian economy, began to appear. However, the implementation of various macroprudential measures that helped contain the growing vulnerabilities of the financial and non-financial sectors as well as sound fiscal and foreign positions contributed to making the impact smaller than expected.

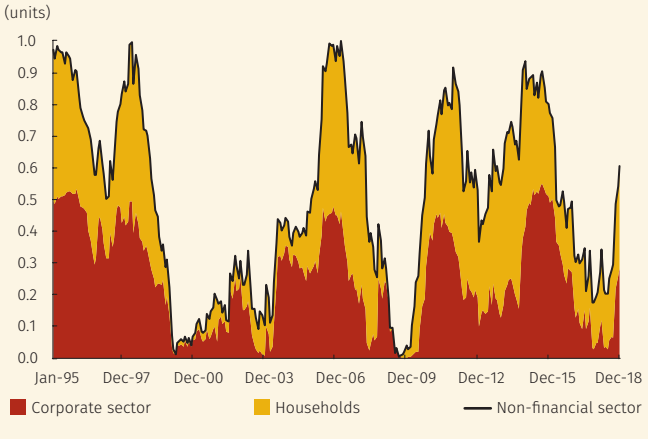
- Period (iv) exhibits a rise in foreign and sovereign imbalances as a direct consequence of the shock to the Colombian economy's terms of trade generated by the drop in petroleum prices. The above resulted in an economic downturn which, in turn, reduced the debtors' ability to pay their obligations with the financial system. This is what is seen in an increase in the corporate sector's vulnerability because of more deterioration in the indicators of debt service and leverage. These vulnerabilities resulted in high levels of default and in a prolonged period of low growth for the credit portfolio.

Graph B2.3
Indicator of Financial Sector Vulnerability



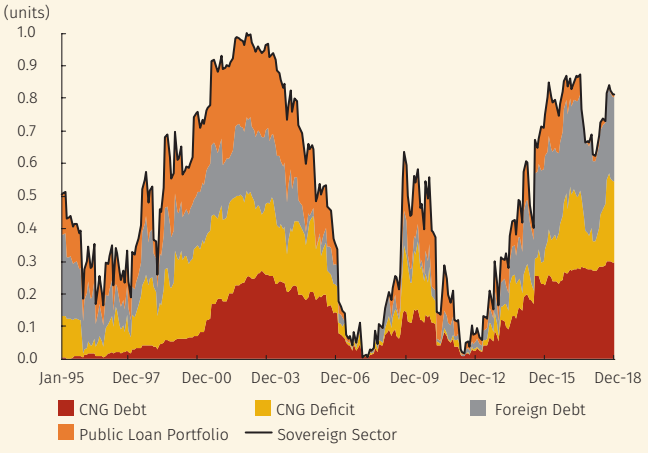
FSources: Office of the Financial Superintendent of Colombia, DANE, Bloomberg, Ministry of the Treasury, and *Banco de la República*, calculations by *Banco de la República*.

Graph B2.4
Indicator of the Non-financial Sector Vulnerability



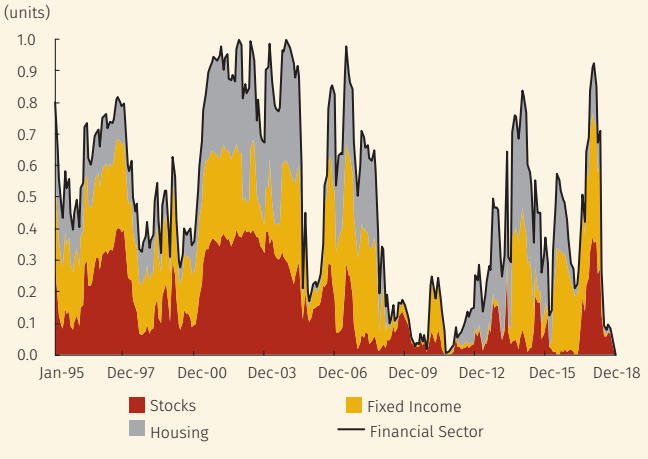
Sources: Office of the Financial Superintendent of Colombia, DANE, Bloomberg, Ministry of the Treasury, and *Banco de la República*, calculations by *Banco de la República*.

Graph B2.5
Indicator of Sovereign Sector Vulnerability



Sources: Office of the Financial Superintendent of Colombia, DANE, Bloomberg, Ministry of the Treasury, and *Banco de la República*, calculations by *Banco de la República*.

Graph B2.6
Indicator of Market Vulnerability



Sources: Office of the Financial Superintendent of Colombia, DANE, Bloomberg, Bloomberg, Ministry of the Treasury, and *Banco de la República*, calculations by *Banco de la República*.

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Box 3
Indicator of Financial Conditions

Wilmar Cabrera
Santiago Gamba*

In their publication of the April 2017 *Global Financial Stability Report*, the International Monetary Fund (IMF) showed an indicator that seeks to approximate the ease of getting access to funding for a group of economies. The intention of this financial condition indicator (FCI) is to capture the common trends of a set of financial variables while excluding the macroeconomic environment.

An indicator is proposed in this Box that has the same purpose as the FCI has in the IMF. Nevertheless, instead of using a model of factors to control for the macroeconomic environment, the decision was made to carry out a 2-stage estimate where: 1) a Vector Autoregressive model (VAR) is estimated which makes it possible to break down the trend of each variable in the model with respect to the contribution of financial and macroeconomic shocks and 2) A principal component analysis is used to find the common trend of the financial series after excluding the effect of the macroeconomic variables. This procedure is explained in greater detail below.

First, a VARl(1) is estimated for the entire set of variables. This model can be expressed as follows:

$$\begin{bmatrix} F_t \\ M_t \end{bmatrix} = \beta_0 + \beta_1 \begin{bmatrix} F_{t-1} \\ M_{t-1} \end{bmatrix} + \begin{bmatrix} u_{F,t} \\ u_{M,t} \end{bmatrix} \qquad (1)$$

Where F_t represents the financial variables, M_t the macroeconomic variables, β_0 and β_1 are parameter vectors to be estimated and $u_{F,t}$ and $u_{M,t}$ are the vectors of errors in the model associated with the financial and macroeconomic variables respectively. Starting with equation 1, the model is restated as a VMA (∞) in order to find the contribution of macroeconomic shocks to the changes in the model series.

$$\begin{bmatrix} F_t \\ M_t \end{bmatrix} = \bar{\beta}_0 + \begin{bmatrix} \Psi(L)_{FF} & \Psi(L)_{FM} \\ \Psi(L)_{MF} & \Psi(L)_{MM} \end{bmatrix}_{L=0,\ldots,\infty} \begin{bmatrix} u_{F,t} \\ u_{M,t} \end{bmatrix} \qquad (2)$$

Where, $\bar{\beta}_0$ is the non-conditional mean vector, and $\Psi(L)_{FF}$, $\Psi(L)_{MF}$ and $\Psi(L)_{MM}$ are lag operator polynomial matrices that contain coefficients which are found based on β_0 and β_1. Finally, the series of financial variables separating the macroeconomic conditions is defined as:

$$\tilde{F}_t = F_t - \psi(L)_{FM}\, u_{M,t} \qquad (3)$$

Finally, the FCI is defined as the first principal component of the vector of variables $\tilde{F}_t$. Table B3.1 presents the financial and macroeconomic variables that are used to estimate the indicator. This series corresponds to a subset of the variables suggested by the IMF that are adapted to the Colombian situation.

Graph B3.1 presents the behavior of the FCI over time. Note that, in general, the indicator identifies the following periods: 1) between September 2006 and March 2008, the financial conditions were the most favorable for the sample analyzed, which coincided with a boom in commercial and consumer loans, and 2) restrictive financial conditions between March 2009 and March 2011 which, together with the global financial crisis, could be explained by the materialization of risks that had accumulated during the previous period. Last of all, financial conditions have remained stable at slightly below their long-term average during the most recent period.

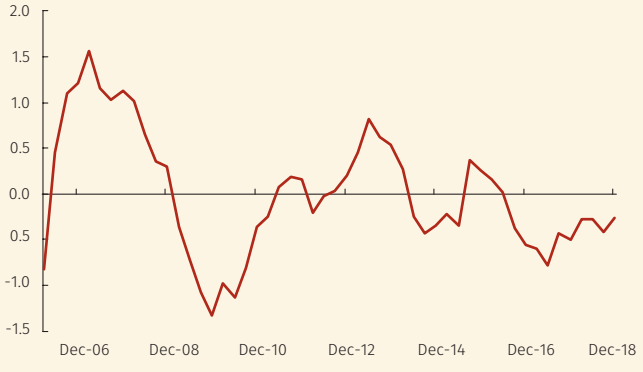
* The authors are part of the Financial Stability Department in *Banco de la República*. The opinions expressed here are the sole responsibility of the authors and do not imply any commitment on the part of *Banco de la República* or its Board of Directors.

Table B3.1
Variables in the Financial Condition Indicator

Variables	Description
Macroeconomic	
Monetary Policy Interest Rate	
Real GDP Annual Growth	
Inflation	
Financial	
Term premia of the TES curve	Difference between the return on a 10-year and a one-year TES bond
Interbank Premia	Difference between the Interbank Rate IBR and the return on a 3-month TES bond
Real long-term return	Annual change in the return on a 10-year TES bond adjusted for inflation
Colcap	Annual difference of the logarithm of the Colcap index
NHPIBR	Real annual change of *Banco de la República*'s new housing price index
Real Growth of the Loan Portfolio	Real annual change in the CIs total loan portfolio

Sources: DANE, Bloomberg, Precia, Office of the Financial Superintendent of Colombia, and *Banco de la República*.

Graph B3.1
Financial Condition Indicator (FCI)



Sources: DANE, Bloomberg, Precia, Office of the Financial Superintendent of Colombia, and *Banco de la República*, calculations by *Banco de la República*.

02

Vulnerability of the Financial System[3]

Given the potential risks identified in Chapter 1, the exposure of financial intermediaries to these possible sources of vulnerability are evaluated in this section. An overview of the financial system and an analysis of the credit, market, liquidity and trading book interest rate risks that financial institutions are exposed to are presented below.

2.1 Current Situation of the Financial System

The credit institutions' balance sheets showed a recovery fueled by growing investments and loan portfolios.

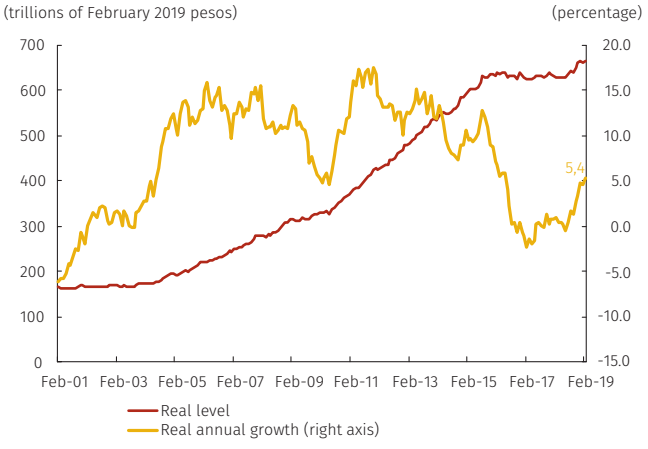
As of February 2019, the credit establishments' (CI) assets came to COP 662.7 trillion (t) which represented a real annual expansion of 5.4%.[4] This growth is higher than what was reported a year ago and is above the average for the last five years (4.6%, Graph 2.1). The above has interrupted a prolonged sluggish period of low asset growth. This situation has not been registered since the financial crisis of the late 1990s. In line with the faster pace with which assets were expanding, the liabilities of the CI grew 3.7 percentage points (pp) more than what was seen a year ago when it had grown 1.0%.

3 The cut-off date for the data presented in this section is February 2019. This information is not included in the National Savings Fund.

4 The real growth was calculated by using the consumer price index (CPI) excluding food.

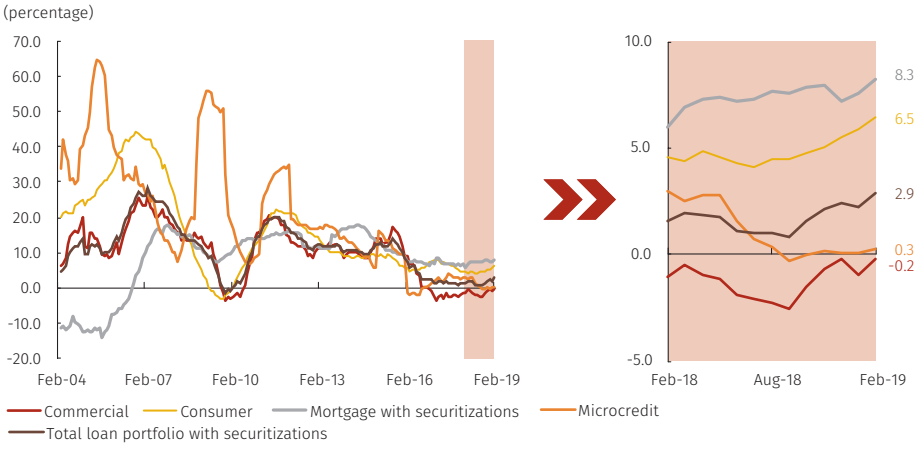
The better growth of the assets has been led by investments, which represented 19.3% of the total assets, in comparison to the 18.5% from a year ago, as they expanded at a rate of 10.8%. Regarding the loan portfolio, upsurges were registered for all the modalities after the stagnation seen since the beginning of 2017, except for microcredit portfolio. In particular, the total portfolio with securitization has grown at its fastest pace since July 2016 (Graph 2.2). This performance coincided with a greater demand for loans within the economy and with a decline in the requirements to be met before loans are granted (Graph 2.3). In this respect, the expected macroeconomic reinforcement for Colombia could potentially raise debtors' creditworthiness and stimulate demand, thus improving the performance of the loan portfolio in the near future.

Graph 2.1
CI Assets



Sources: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República.*

Graph 2.2
Annual real growth of loan portfolios by modality



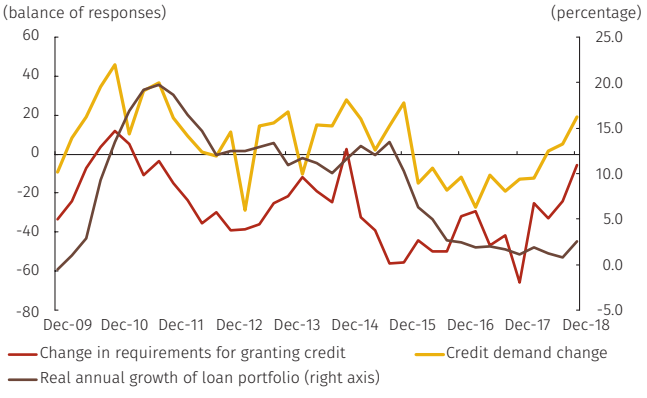
Source: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República.*

On the other hand, the credit risk indicators showed improvements as a result of the downturn in the risky and non-performing loan portfolios.

During the last six months, the quality risk indicator (QRI)[5] for the total portfolio showed a decrease and stood at 10.0%, halting the growth trend that the indicator has registered since the end of 2015. Declines in the QRI were seen for all of the loan portfolios with the exception of housing and microcredit, which remained constant (Graph 2.4, panel A). This decline was mainly due to the slowdown in the risky portfolio, which went from growing at 8.7% to 0.9%, during the period under analysis.

5 The QRIis defined as the ratio between the risky and the total loan portfolio (the risky loan portfolio corresponds to the balance of the loans with ratings other than A on a scale from A to E where A is the best rating).

Graph 2.3
Perception Change of Credit Supply and Demand



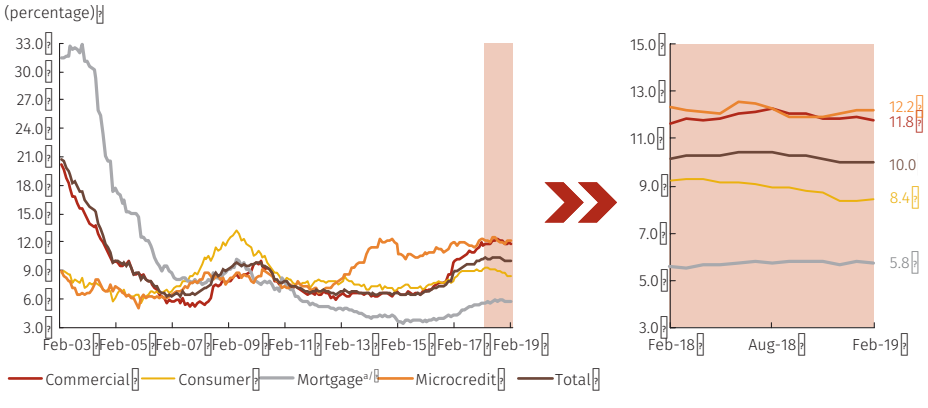
Note: The percentage of the balance of responses is calculated as the difference between the percentage of respondents who stated that the requirements were less restrictive and the demand for credit greater, and those who noted increased requirements and less demand for credit. A positive result in the balance is interpreted as that credit institutions are being less restrictive, and that demand has grown.
Source: Report on the Credit situation in Colombia, *Banco de la República.*

The non-performing loan indicator (NPL),[6] in turn, was similar to the QRI as it registered a level that was 27 basis points (bp) lower than what was seen six months ago (Graph 2.4, panel B). The decline in the indicator during the period under analysis is explained by the fall of the NPL for all of the portfolios.[7] The non-performing loan portfolio slowed down in all of the modalities, thus showing a real annual decrease of 26.2% as of February 2019 which is a lower rate than was seen six months ago (27.6%).

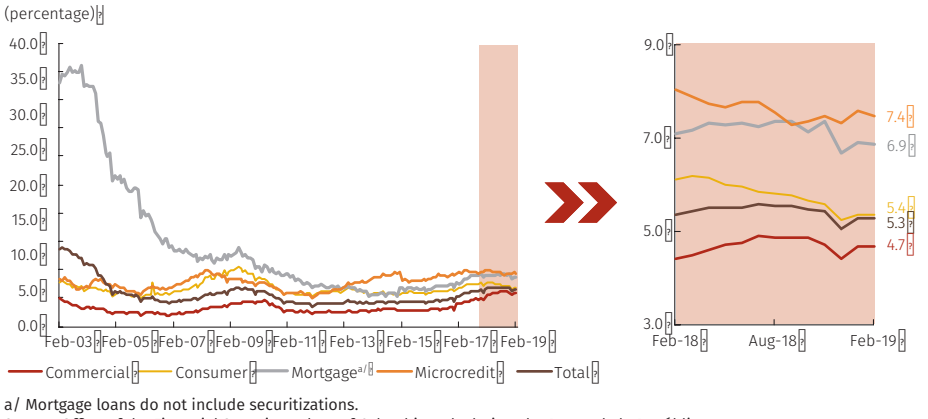
The downward trend in the indicators of profitability has reversed in recent months due to the slowdown in expenditures on loan-loss provisions.

Graph 2.4

A. Quality risk indicator (QRI)



B. Non-Performing loans indicator (NPI)



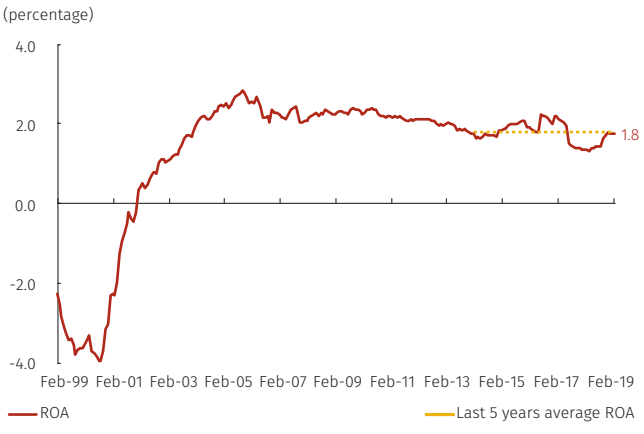
a/ Mortgage loans do not include securitizations.
Source: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República.*

6 The quality indicator by default QID is calculated as the ratio between the non-performing and total loan portfolios (the past-due portfolio includes the balance of the loans that have been in arrears for more than 30 days).

7 When the penalties are included in the calculation of the NPL, a stability is registered in the indicator, which closed at 10.2% as of February 2019. This performance is a result of a deterioration in the commercial and microcredit portfolios, and improvements in the housing and consumer loan portfolios.

In February 2019 the return on assets (ROA) indicator stood at 1.8%. This represents a recovery after the fall seen in 2017 and 2018 (Graph 2.5).[8] The return on equity (ROE), in turn, closed at 12.4% thus showing a trend that is similar to that of the ROA. The recovery last year made it possible for the profitability indicators to be close to the average for the past five years. This increase in profits was explained mainly by the decrease in expenditures on loan-loss provisions. The indicator of core capital adequacy at the individual level, in turn, declined 31 bp while the total capital adequacy fell 34 bp, when it stood at 11.1% and 16.0% respectively, or approximately 7 pp above the regulatory minimums for the two measurements.[9] As of December 2018, the indicator of core and total capital adequacy at the consolidated level stood at 9.7% and 13.5%, respectively.[10]

Graph 2.5
Return on Assets (ROA)



Source: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República.*

Assets that non-banking financial institutions hold in proprietary and managed position continued to show a higher rate of growth than what was registered for the entire financial system.

In February 2019, the assets of the Non-banking Financial Institutions (NBFI) in their proprietary position stood at COP 93.4 t and represented 5.3% of the financial system assets. Its real annual growth was 9.3%. The companies that showed the largest growth in assets in their proprietary position were the insurance companies. These had an annual growth of 11.8%. The stock-brokerage firms, in turn, presented a 16.7% decrease in the size of their assets. This contrasts with the situation six months ago when their assets grew at 6.6% (Table 2.1).

Regarding the portfolio managed by the NBFI, the balance amounted to COP 849.5 t which is equivalent to 48.4% of the financial system assets as of February 2019. With respect to September 2018, the real growth rate showed a stable performance of these portfolios as they went from growing at a rate of 5.8% to one of 6.0% (Graph 2.6). This occurred as a result of the positive growth rates in all types of assets managed by the NBFI with the exception of the voluntary pensions managed by insurance companies which, at that time, registered a 5.0% decrease but represent a relatively low share of the total managed assets.

8 The positive jump that was seen in June 2016 was due to the decision made by the Banco de Bogotá to deconsolidate Corficolombiana.

9 The regulatory limits for total capital adequacy and core capital adequacy are 9.0% and 4.5% respectively.

10 Does not include information from Banco Coopcentral due to data availability.

Table 2.1
Non-banking Financial Institutions' Proprietary and Third-party Assets

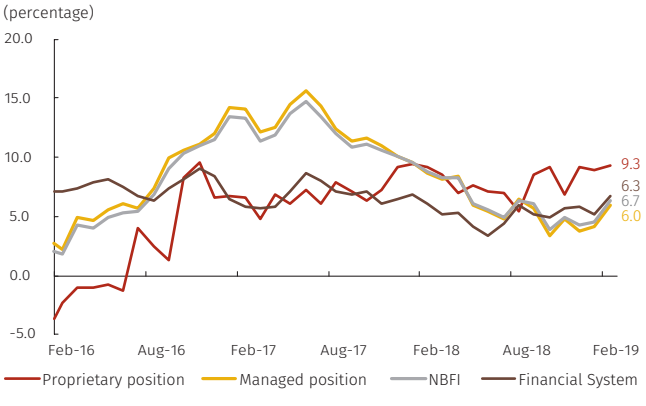
Non-bank Financial Institution Assets	Sep-18			Feb-19		
	Trillions of Colombian pesos	Financial system asset percentage	Annual real growth (percentage)	Trillions of Colombian pesos	Financial system asset percentage	Annual real growth (percentage)
Proprietary Position	88.8	5.2	8.6	93.4	5.3	9.3
Pension Fund Managers (PFM)	6.2	0.4	5.2	6.3	0.4	5.9
Trust Companies (TC)	3.5	0.2	8.9	3.5	0.2	3.8
Brokerage Firms (BF)	4.1	0.2	6.6	4.5	0.3	-16.7
Insurance Companies	75.0	4.4	9.0	79.2	4.5	11.8
Assets Under Management	824.5	48.7	5.8	849.5	48.4	6.0
PFM: Mandatory pensions	241.8	14.3	4.5	245.8	14.0	4.6
PFM: Voluntary Pensions	18.5	1.1	6.9	18.8	1.1	3.6
PFM: Severances	12.1	0.7	3.8	16.4	0.9	4.4
TC	525.7	31.1	6.2	542.0	30.9	6.6
SBF[a/]	26.0	1.5	7.9	26.2	1.5	9.2
Insurance: Voluntary Pensions	0.3	0.0	2.4	0.3	0.0	-5.0
Total Non-bank Financial Institutions	913.3	54.0	6.0	942.9	53.8	6.3
Total Financial system	1,692.7	100.0	5.1	1,754.0	100.0	6.7

Note: data expressed in February 2019 Colombian pesos.
a/ Corresponds to Collective Investment Funds administered by the SBFs.
Source: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República.*

Between September 2018 and February 2019, the ROA of the NBFIs registered decreases as a result of depreciations of the stock market, which showed a slight decline. However, this indicator remains above the average of the last five years.

Regarding the profitability of the NBFI, the ROA of the TC, PFM, and SBF stood at 15.9%, 12.4%, and 2.1% respectively. These figures are lower to those seen in September 2018 (Graph 2.7, Panel A). With respect to the ROA for the life and general insurance companies, this registered figures of 3.1% and 1.8% respectively during the period under analysis (Graph 2.7, Panel B). In general, the NBFI profitability levels have stood at around the average for the last five years although their trend has been in a decline over the past year primarily as a result of the performance of the stock market.

Graph 2.6
Growth of Financial System Assets



Source: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República.*

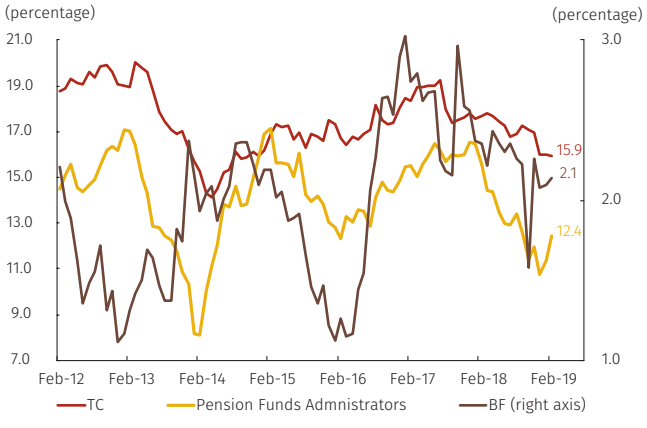
The yield of the institutions of the financial system has been affected by the performance of the economy. However, the transmission channel has been different depending on the type of entity.

In conclusion, a recovery can be seen in the profitability indicators of the CIs as of February 2019. The indicators for the NBFI are fluctuating around

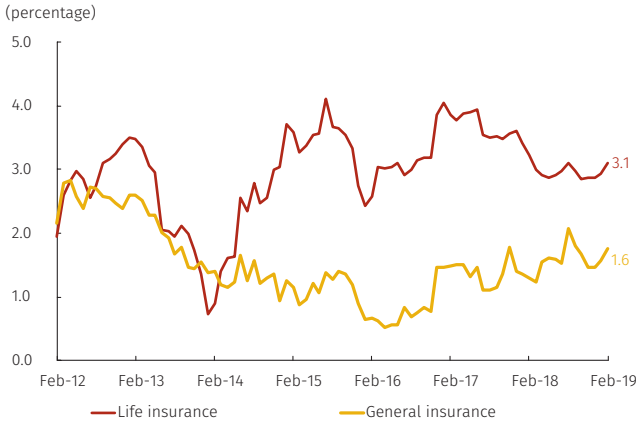
their historical averages although there have been changes in the market that have affected their results.

Graph 2.7
Returns on Assets of Non-Banking Financial Institutions

A. Trust Companies and Brokerage Firms



B. General and life insurance companies



Source: Office of the Financial Superintendent of Colombia, *Banco de la República* calculations.

2.2 Credit Risk

The analysis of credit risk presented below has two parts. The first subsection studies the development of corporate sector indebtedness and the perception and materialization of private companies' credit risk. The second subsection identifies the indebtedness and financial burden on households and presents some risk indicators related to the performance of this portfolio.

2.2.1 Corporate Sector[11]

2.2.1.1 Change in corporate sector indebtedness

The increase in corporate sector debt as a percentage of GDP was caused by an increase in loans denominated in foreign currency from foreign financial institutions received by the private corporate sector.

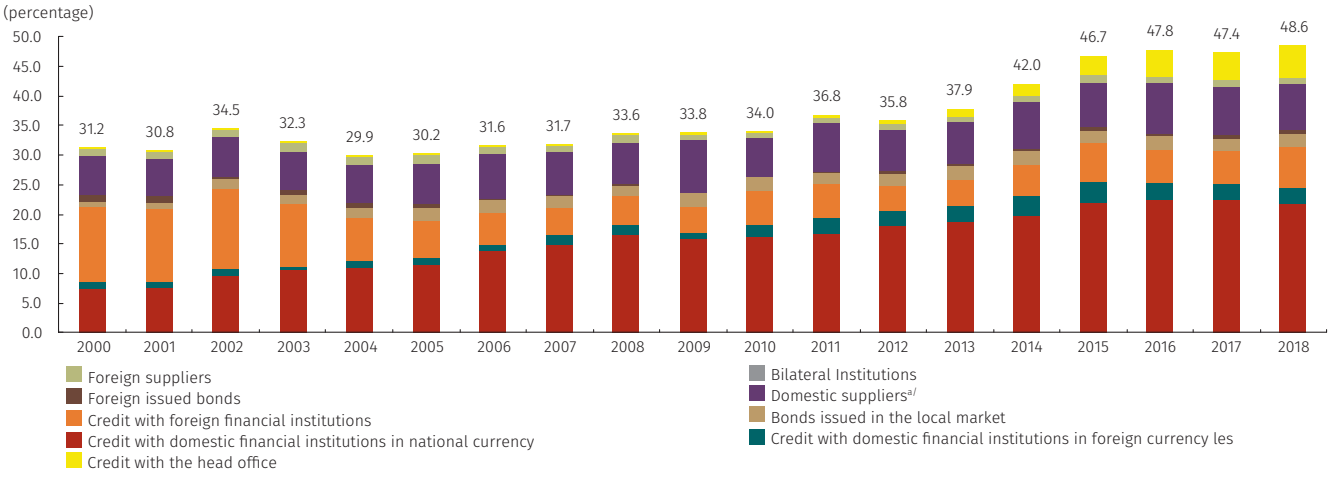
As of December 2018, the total indebtedness of the corporate sector as a share of annualized GDP stood at 56.7%, showing a rise with respect to the 56.2% registered in December 2017. Of the total, the private corpora-

11 Due to availability of information from the FSC Format 341, "Individual Information by Debtor: Active Credit Transactions," the figures in this section were submitted as of December 2018.

te sector[12] contributed 48.6 pp. This sector showed an increase spurred mainly by indebtedness to foreign financial institutions (Graph 2.8, panel A). Regarding the public corporate sector, there was a decline in indebtedness led by the prepayment of bonds abroad[13] (Graph 2.8, panel B).

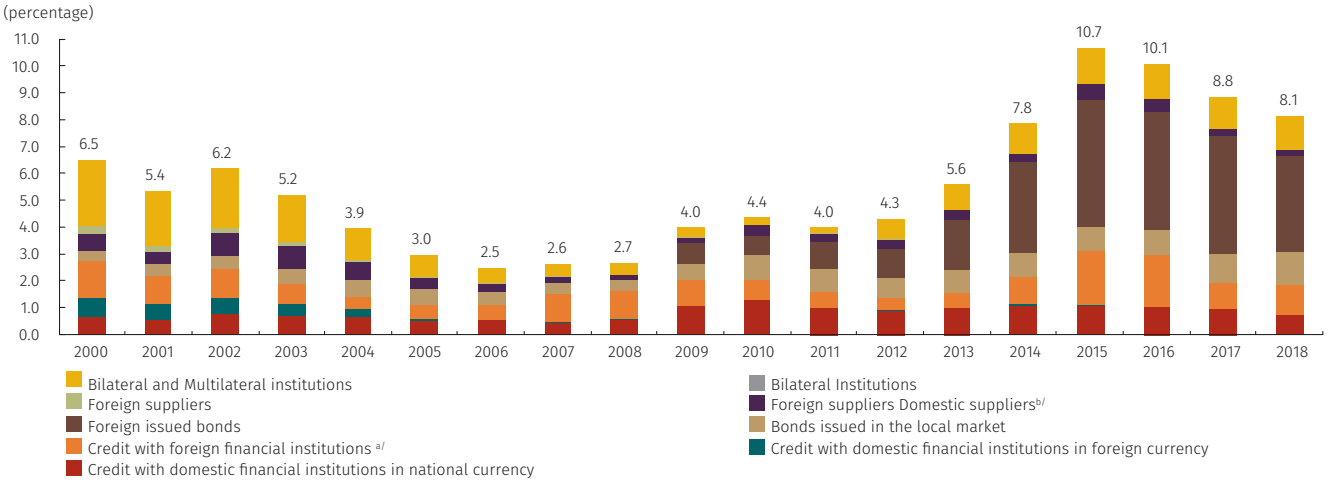
Graph 2.8
Financial Debt of the Corporate Sector as a Percentage of GDP by Instrument

A. Private corporate sector



a/ This only includes information from companies that report their financial statements to the Office of the Superintendent of Corporate Affairs. In the year 2017, all of the companies registered their financial statements using IFRS which did not make it possible to determine the balance of debt owed to national institutions. Therefore, in order to do an approximation of the data from these companies, the average percentage that the short and long-term providers reported under current and non-current liabilities respectively, during this period, for the companies that reported between 2007 and 2015 using the UAP was calculated, and an equal percentage for the institutions that submitted financial statements in 2017 was assumed. Based on data availability as of June 2017, a provider balance that is equal to what was estimated for December 2017 is assumed.
Sources: Office of the Financial Superintendent of Colombia, Office of the Superintendent of Corporate Affairs, and *Banco de la República*, calculations by *Banco de la República*.

B. Public Corporate Sector



a/ Does not include financial leasing operations.
b/ Includes information from the account payable balance of the public sector non-financial companies.
Sources: Office of the Financial Superintendent of Colombia, General Accounting Office, Ministry of Finance and Public Credit; calculations by *Banco de la República*.

12 Throughout the entirety of this section, the term "private corporate sector" refers to private companies and excludes those monitored by the FSC.

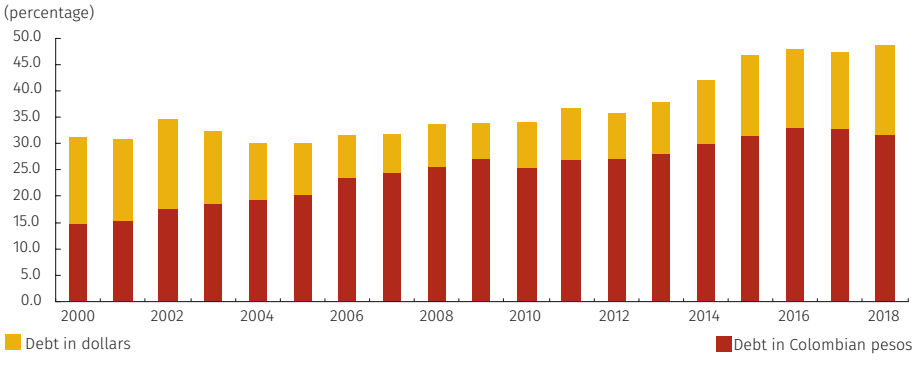
13 As a percentage of the GDP, the debt in bonds issued abroad was 0.8 pp less with respect to what was registered in December 2017. This decrease was largely because of prepayments on the debt made by Ecopetrol and the Grupo de Energia de Bogota.

In addition, the main sources of funding for the private sector at the time of analysis continued being loans in legal currency from local financial institutions and from foreign lenders for the case of foreign currency. For the public sector, the main sources are bonds issued in foreign markets. It is also evident that the least sources of financing used by the two sectors are, respectively, bonds issued abroad and foreign providers.

When viewed by type of currency, private companies continue acquiring the majority of their debt in pesos and the increase in aggregate debt as a percentage of GDP is due to the rise in debt denominated in foreign currency. This occurred in a context in which the exchange rate rose 8.9% between December 2017 and the same month in 2018.14 The public companies, in turn, continued to prefer borrowing in foreign currency. However, since 2015, this debt has been showing a reduction as a percentage of GDP (Graph 2.9).

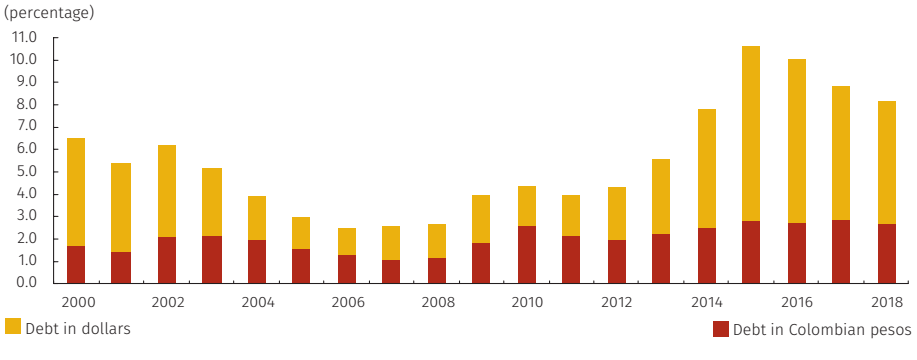
Graph 2.9
Corporate Sector Financial Debt as a Percentage of GDP by Currency

A. Private Corporate Sector[a/]



a/ Calculated with the same data as Graph 2.8, panel A.
Sources: Office of the Financial Superintendent of Colombia, Office of the Superintendent of Corporate Affairs, and *Banco de la República,* calculations by *Banco de la República*.

B. Public Corporate Sector[b/]

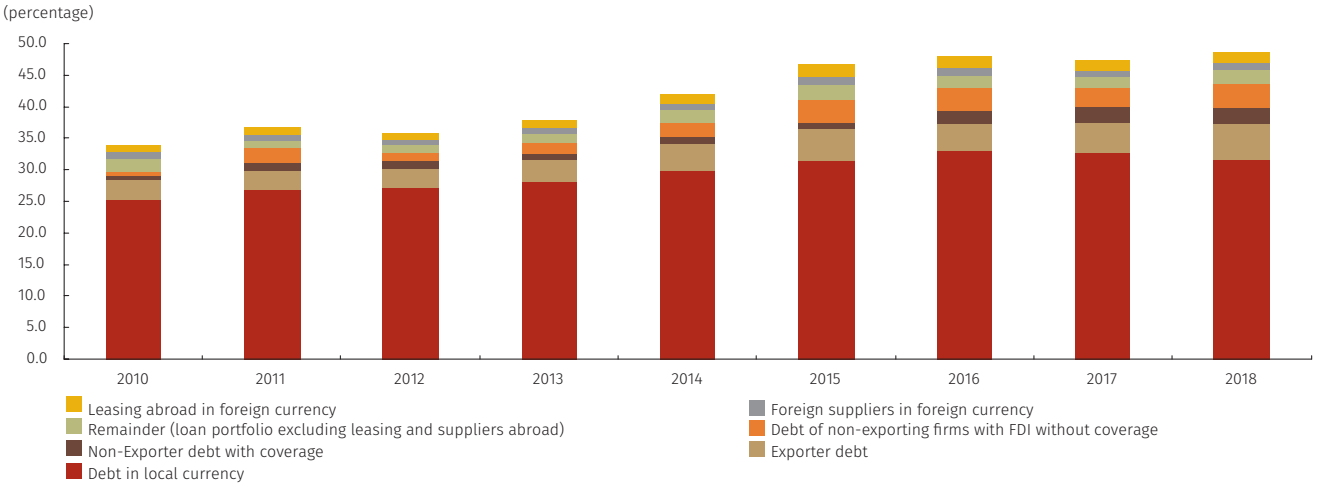


b/ calculated with the same data as Graph 2.8, panel B.
Sources: Office of the Financial Superintendent of Colombia, General Accounting Office, Ministry of Finance and Public Credit; calculations by *Banco de la República*.

14 If the exchange rate had remained at the level registered during the last month of 2017, the private corporate sector debt as a percentage of GDP would have been 1.2 pp lower than the share observed in December 2018.

Debt denominated in foreign currency may be a source of vulnerability for the corporate sector to the extent that it exposes firms to fluctuations in the exchange rate. Nevertheless, the exposure to exchange rate risk is mitigated if the company is an exporter, if it is hedged (through the use of derivatives), or if it has the backing of a foreign institution (i.e., through Foreign Direct Investment, FDI). Based on information up until 2018, Graph 2.10 shows the private corporate sector's financial debt by currency hedging and by the debtor's foreign trade as a share of GDP. This graph shows that between 2017 and 2018, the share of debt in foreign currency held by non-exporting companies with FDI but without hedging, the share for exporting companies, and the debt held by non-exporting companies without FDI or hedging (those that are the most exposed to currency risk) rose.

Graph 2.10
Private Corporate Sector Financial Debt as a Share of GDP by Exchange Rate Coverage and Debtor Foreign Trade



Note: the debt in foreign currency includes only loans (excluding leasing) and bonds. Suppliers are not included since the information is not available by TIN.
Sources: Office of the Financial Superintendent of Colombia, DANE, and *Banco de la República*, calculations by *Banco de la República*.

2.2.1.2 Sector Analysis[15]

In the loan portfolio granted to companies in the private sector, the share held by the financial and other services sectors increased.

The economic sectors with the largest shares of loan portfolio granted to the private corporate sector were commerce, manufacturing, and construction: as a whole, they accounted for 54.7% of this portfolio as of December 2018. In contrast, mining, restaurant and hotels, and health are the economic sectors with the lowest shares. With respect to the previous

15 In this subsection, abbreviations will be used for the following sectors: 1) real estate, rentals and business: real estate; 2) agriculture, animal husbandry, hunting, forestry, and fishing: agricultural; 3) mining and quarrying: mining; 4) electricity, gas and water: electricity; 5) transportation, warehousing, and communications: transportation; and 6) financial intermediation: finance.

year, the financial and other services sectors[16] were the ones that gained a larger share, while trade, real estate, and transportation reduced it (Graph 2.11).

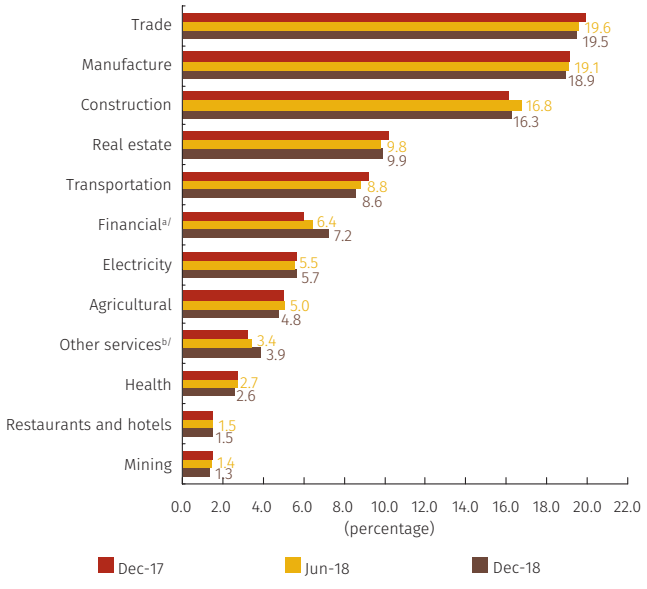
The analysis of various indicators makes it possible to infer that the economic sectors in which the credit risk has risen are, to a great extent, construction and retail trade.

The QIR calculated by economic sector shows that the trade, construction, real estate, electricity, and agricultural sectors were the ones whose indicator rose between December 2017 and December 2018. Nevertheless, the QIR for the real estate, electricity, and agricultural sectors has remained relatively stable over the last six months (Graph 2.12, panel A). Construction is still the sector with the highest contribution to the QIR of the total commercial portfolio (Graph 2.12, panel B).

Regarding construction, the subsectors that contributed the most to the increase in QIR were roads and railways (1.94 pp), residential buildings (1.46 pp), and non-residential buildings (0.59 pp). In the trade sector, in turn, increases are mainly evident in the subsectors of non-specialized retail sales of food (0.88 pp) and wholesale sales of food (0.17 pp). Although the agricultural sector does not hold a large share of the total balance of the private corporate debt, the QIR registered in this sector has remained high since December 2017. The increases in the contribution of the grain (0.66 pp) and mixed farming (0.21 pp) subsectors explain the rise in the QIR of this economic sector.

The high levels of the risk indicators in the construction, electricity, and transportation sectors are largely due to idiosyncratic components. The first sector has been affected by the situation of the *Concesionaria Ruta del Sol S.A.S*; the second, by the loan portfolio of the *Electrificadora del Caribe S. A.*;[17] and the last, by the performance of the companies that provide mass passenger transportation. When these effects are ruled out, it turns out that construction may continue to have a significant effect on the deterioration of the private corporate sector QIR.[18]

Graph 2.11
Breakdown of Private Corporate Sector Loan Portfolio Balance by Economic Sector



a/ The financial and insurance sector excludes the loan portfolio granted to institutions supervised by Office of the Financial Superintendent of Colombia.
b/ 'Other services' groups firms belonging to the following economic sectors: public administration and defense, education, other community, social and personal service activities, private households with domestic servants, and the organizations and extraterritorial institutions.
Sources: Office of the Financial Superintendent of Colombia, Office of the Superintendent of Corporate Affairs, and *Banco de la República*; Calculations by *Banco de la República*.

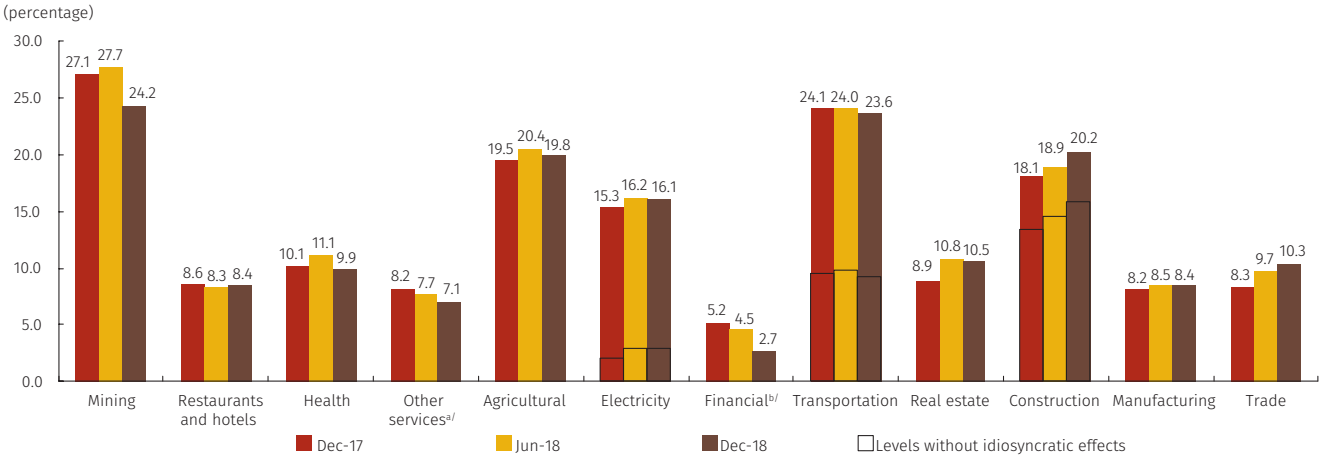
16 The firms that belong to the following economic sectors are grouped under other services: public administration and defense, education, health and social services, other community, social, and personal services, private households with domestic help, and extraterritorial organizations and institutions.

17 As of December 2018, the CI had 100% of the *Electrificadora del Caribe S.A.*'s loan portfolio covered by loan-loss provisions.

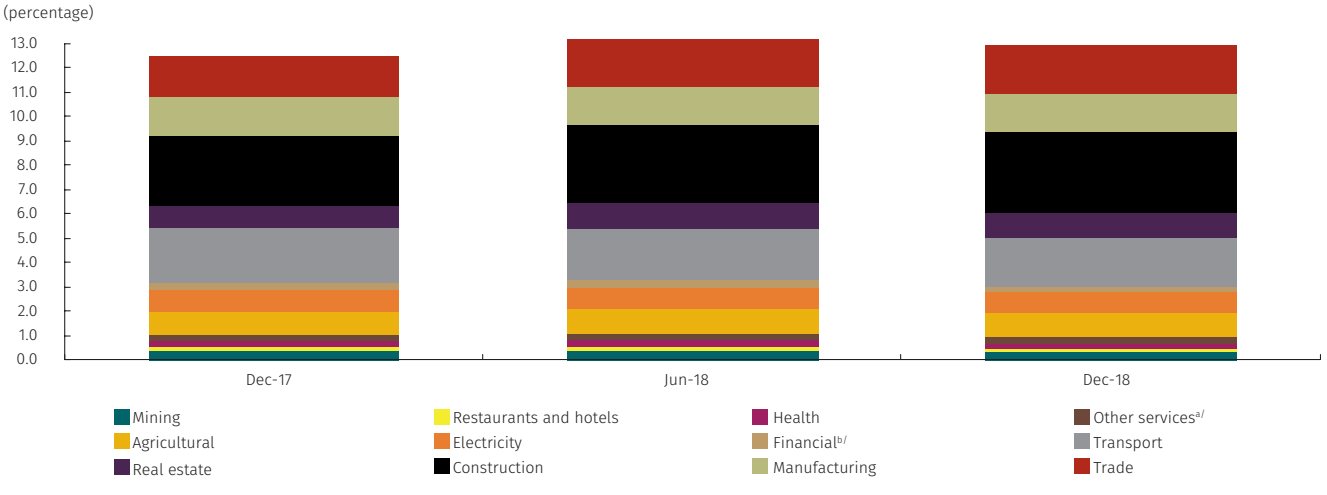
18 When ruling out the effect of the idiosyncratic components, the QIR for construction rises 2.4 pp between December 2017 and December 2018.

Graph 2.12
QRI of private corporate sector

A. QRI by Economic Sector



B. QRI Contribution by Economic Sector



a/ 'Other services' groups firms belonging to the following economic sectors: public administration and defense, education, social and health services, other community, social and personal service activities, private households with domestic servants, and the organizations and extraterritorial institutions.
b/ The financial and insurance sector excludes the loan portfolio granted to institutions supervised by Office of the Financial Superintendent of Colombia.
Sources: Office of the Financial Superintendent of Colombia, Office of the Superintendent of Corporate Affairs, and *Banco de la República*; Calculations by *Banco de la República*.

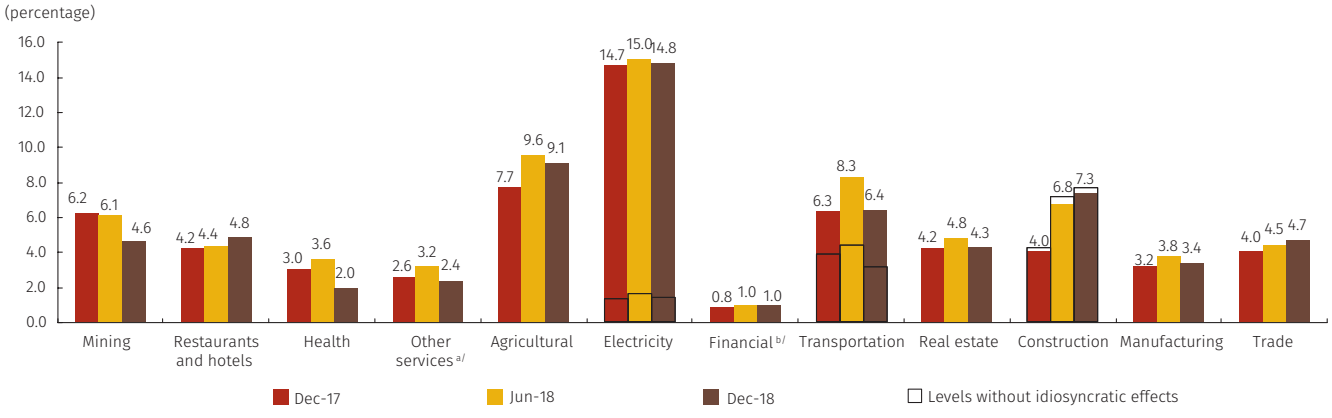
The NPL calculated by sectors shows that construction, agriculture, trade, and restaurants-and-hotels[19] are the ones whose indicator increased the most over the past year. Besides, the first three were the ones that most contributed to the growth of the indicator for the entire commercial loan portfolio (Graph 2.13). Thus, the rises in perceived risks in the first three sectors measured by the QIR have materialized in higher levels of default.

In order to do a more thorough analysis of the performance of loans disbursed to firms, two additional credit risk indicators were calculated which enabled to identify episodes of major vulnerability for the CI: the

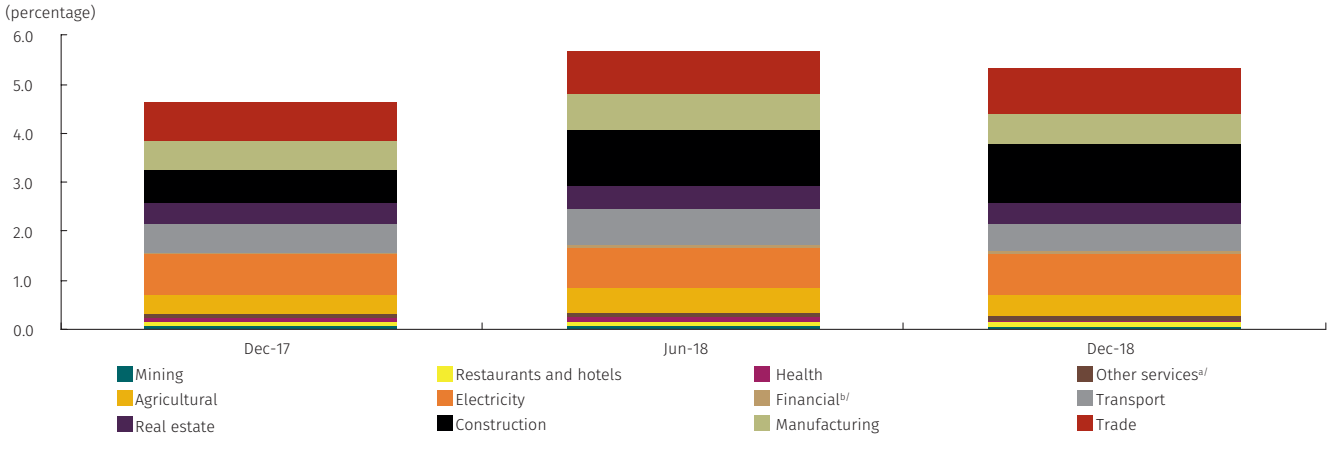
19 The subsectors that drove the growth of the QID in this sector were restaurants, self-service restaurants, and other types of meal services.

Graph 2.13
Private Corporate Sector NPL

A. NPL by Economic Sector



B. NPL Contribution by Economic Sector



a/ 'Other services' groups firms belonging to the following economic sectors: public administration and defense, education, other community, social and personal service activities, private households with domestic servants, and the organizations and extraterritorial institutions.
b/ The financial and insurance sector excludes the loan portfolio granted to institutions supervised by Office of the Financial Superintendent of Colombia.
Sources: Office of the Financial Superintendent of Colombia, Office of the Superintendent of Corporate Affairs, and *Banco de la República*; Calculations by *Banco de la República*.

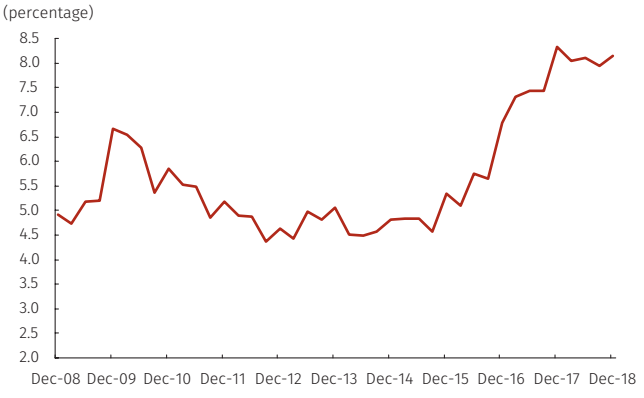
indicator of risk perception by rating (IRPR) and the weighted indicator of migrating to a worse rating.

The IRPR is the percentage of loans, in terms of their balance, that have a worse rating than they would if only the days past due were taken into account.[20] The indicator stood at a level similar to the one reported a year ago. This occurred after a period of stabilization over the course of 2018, which contrasted to the growing trend that this indicator had been showing since December 2015 (Graph 2.14, panel A). By economic

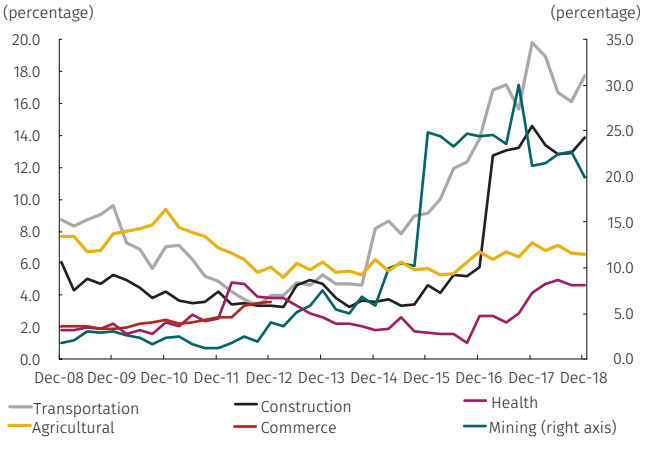
20 According to Chapter II, Appendix 1 of the Basic Accounting and Financial Circular issued by the FSC, if only the days past due were taken into account, the commercial loans would be rated as follows: 1) category A: loans that are past due by a month or less; 2) category B: loans that are past due by one to three months; 3) category C: loans that are past due by more than three and up to six months; 4) category D: loans that are past due by more than six and up to 12 months; and 5) category E: loans past due for more than 12 months.

Graph 2.14
Indicator of Risk Perception by Rating

A. Corporate Sector Total Loan Portfolio



B. By economic sector



Source: Office of the Financial Superintendent of Colombia; calculations by *Banco de la República*.

sector, the health,[21] trade, and real estate indicators showed growth with respect to their performance of the last year. Transportation, construction, and mining, in turn, are still the sectors with the highest indicators (Graph 2.14, panel B).

The weighted indicator of migrating to a worse rating is calculated by both value of loans and number of operations.[22] Graph 2.15, panel A shows that the aggregate indicator by both value and number of operations has been showing a growth trend since the first quarter of 2012. However, in December 2018, the increase was greater in the indicator by balance which was reflected in a smaller gap between the two measurements. This points out that the loans that migrated to worse ratings had larger balances than those that migrated in previous periods.

This same analysis performed by economic sector shows that the electricity, construction, agriculture, and transportation sectors have shown increases in both indicators during the last year.[23] For the construction, electricity, and transportation sectors, the rise in the indicator calculated by balance was higher than the one calculated by records. This indicates that loans for larger amounts are migrating to lower ratings (Graph 2.15, panel B).

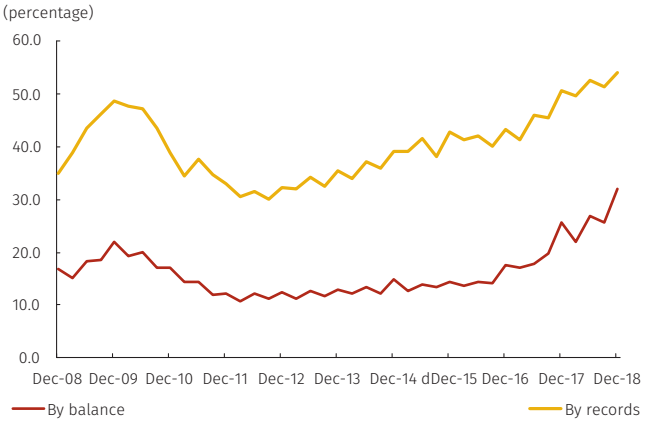
21 In fact, the indicator for the health sector has presented significant growth since the end of 2016 and now stands at its highest levels since 2011. That is why health was included in the stress tests in chapter III of this *Report*.

22 This indicator is calculated by using quarterly information from the FSC format 341 (active credit transactions). The term $P(X_{t-1})$ is assigned to the probability that a credit transaction has been rated with the letter X during the quarter prior to the quarter being evaluated and $P(Y_t|X_{t-1})$ is assigned to the probability that a credit transaction could migrate to the rating Y during the quarter being evaluated given that it was rated with the letter X during the previous quarter. The ratings for the active credit transactions may be any letter within the set $\{A, B, C, D, E\}$ where A is the best rating (least risk) and E is the worst (highest risk). Given this, the weighted indicator of migrating towards a worse rating during the quarter t is calculated as: $P(B_t|A_{t-1})\times 1\times P(A_{t-1})+P(C_t|A_{t-1})\times 2\times P(A_{t-1})+P(D_t|A_{t-1})\times 3\times P(A_{t-1})+P(E_t|A_{t-1})\times 4\times P(A_{t-1})+P(C_t|B_{t-1})\times 2\times P(B_{t-1})+P(D_t|B_{t-1})\times 3\times P(B_{t-1})+P(E_t|B_{t-1})\times 4\times P(B_{t-1})+P(D_t|C_{t-1})\times 3\times P(C_{t-1})+P(E_t|C_{t-1})\times 4\times P(C_{t-1})+P(D_t|D_{t-1})\times 3\times P(D_{t-1})+P(E_t|D_{t-1})\times 4\times P(D_{t-1})+P(E_t|E_{t-1})\times 4\times P(E_{t-1})$. Notice that this is a weighted indicator since the worse the rating that a loan migrates to is, the higher the weighting (which is between 1 and 4) is.

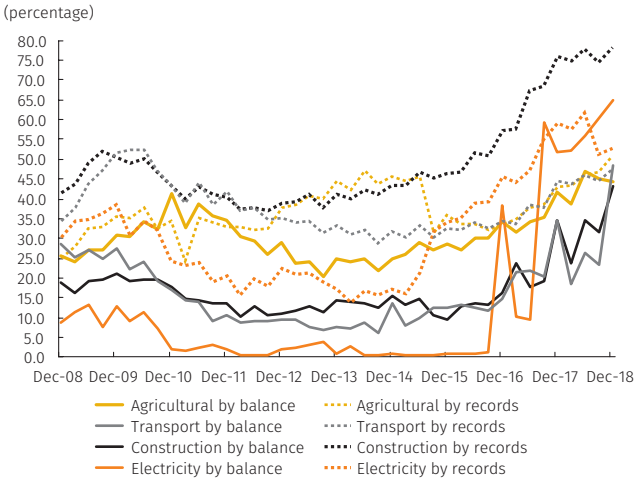
23 In the case of the electricity sector, the increase seen in the indicator by balance is due to the deterioration of Electrificadora del Caribe S. A. When this effect is discounted, the indicator would probably have registered a value of 4.2% in June 2018.

Graph 2.15
Weighted Indicator of Migrating to a Lower Rating

A. Corporate sector total loan portfolio



B. By economic sector



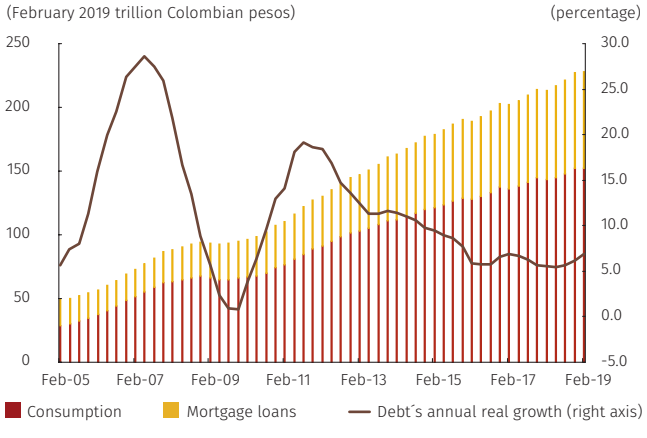
Source: Office of the Financial Superintendent of Colombia; calculations by *Banco de la República.*

2.2.2 Households

The indebtedness of Colombian households, which has been showing a moderate expansion since the beginning of 2016, presented a surge during the past year. By type, the housing loan portfolio has exhibited the greatest growth and has led the expansion observed over the last four years.

The loan portfolio allocated to households[24] stood at COP 228.0 t as of February 2019, registering a real annual growth rate of 6.9%, the highest since March 2017. Approximately two-thirds of total indebtedness corresponds to consumer loans and the remainder to housing. In the recent past, the latter has been rising gradually as a share of the total indebtedness (Graph 2.16).

Graph 2.16
Household debt composition and annual real growth

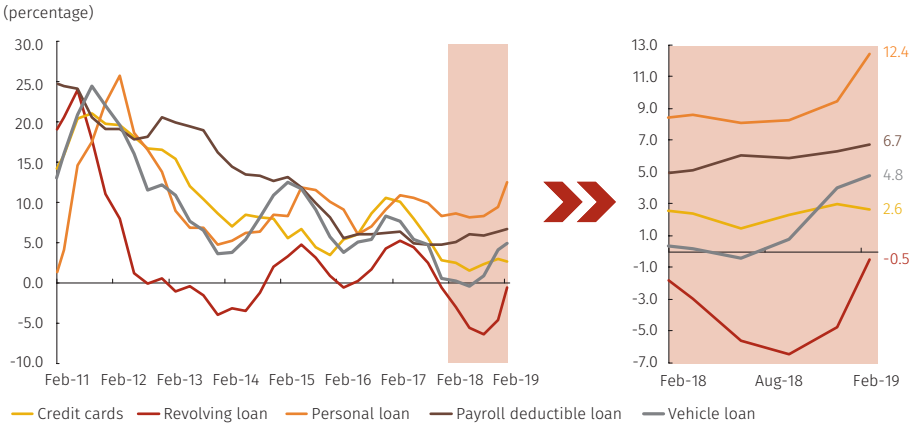


Sources: Office of the Financial Superintendent of Colombia, Superintendencia de la Economía Solidaria (Superintendent of Solidarity Economy) and Titularizadora de Colombia (Colombian Securitization Office); Calculations by *Banco de la República.*

During the period under analysis, the housing loan portfolio expanded 8.5%, above the average of the past four years. The consumer loan portfolio, in turn, showed a recovery during the last half year as it registered a growth rate of 6.1% as of February 2019. This upswing was due to the better performance of the vehicle, payroll deductible loans and personal loans segments with the latter being the one that registered the largest rate of growth as well as the most pronounced acceleration (Graph 2.17).

24 The loan portfolio allocated to households corresponds to the sum of the consumer and housing with securitization loan portfolios granted by credit establishments, the National Savings Fund (FNA in Spanish), savings and loan cooperatives, and employee funds.

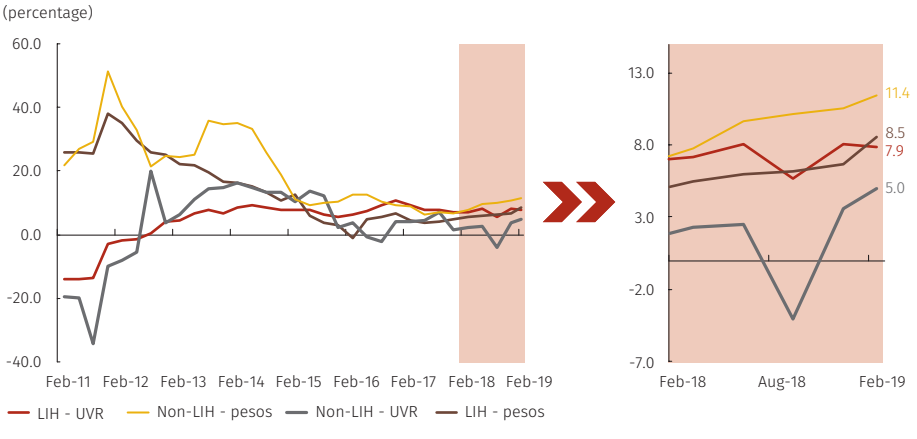
Graph 2.17
Consumption loan portfolio's annual real growth by segment



Sources: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República*.

Regarding the housing loan portfolio, the peso-denominated loans allocated to both low-income housing (LIH) and other than low-income housing (non-LIH), which are the most representative segments in this loan portfolio, registered accelerations over the last year. In contrast, the UVR-denominated loans for the purchase of LIH showed stable growth while the non-LIH registered a better performance in spite of the volatility seen during the latest period (Graph 2.18).

Graph 2.18
Mortgage loan portfolio's annual real growth by segment



Sources: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República*.

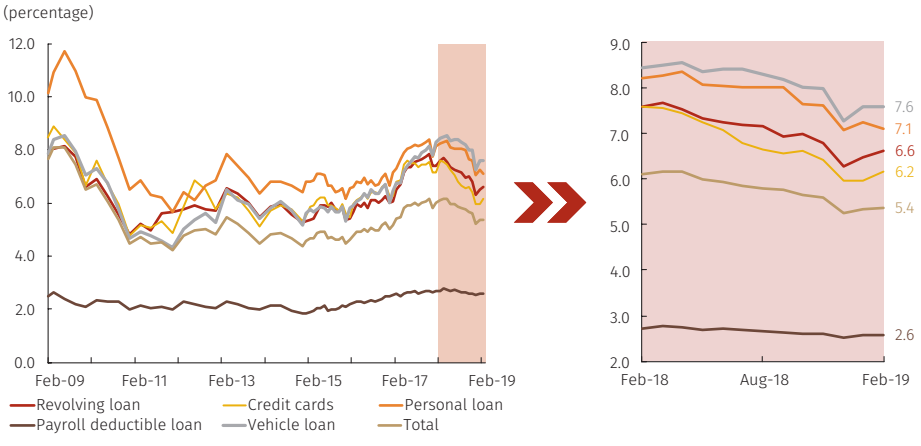
Between February 2018 and 2019, the NPL for consumer and housing loans showed declines. In spite of the above, the perception of risk for the housing loan portfolio continues to rise.

During the past year the delinquency rate for the consumer and housing loan portfolio corrected the growing trend that they had been presenting since the beginning of 2017. A declining trend has been observed for the former since the first quarter of 2018 while for the latter the corrections began in the third quarter. The UVR-denominated segments in the hou-

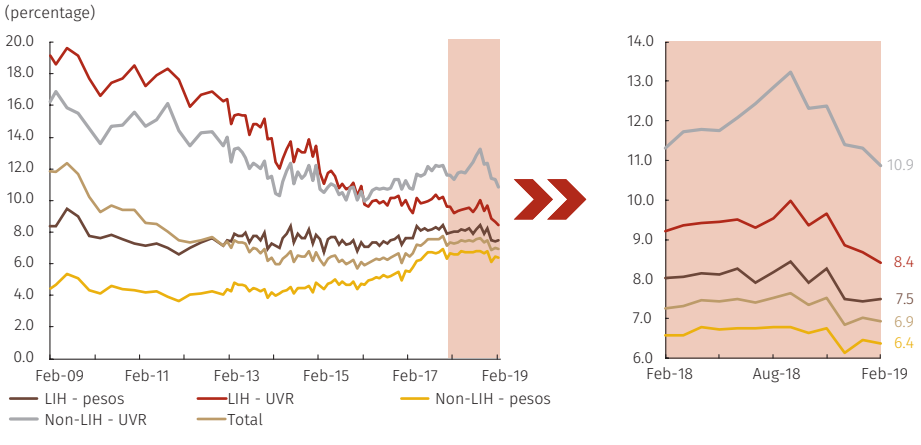
sing loan portfolio continue to show a greater materialization of credit risk in comparison to the peso-denominated segments (Graph 2.19, panels A and B).

Graph 2.19
Non-performing loans indicator (NPL)

A. Consumption loan portfolio



B. Mortgage loan portfolio



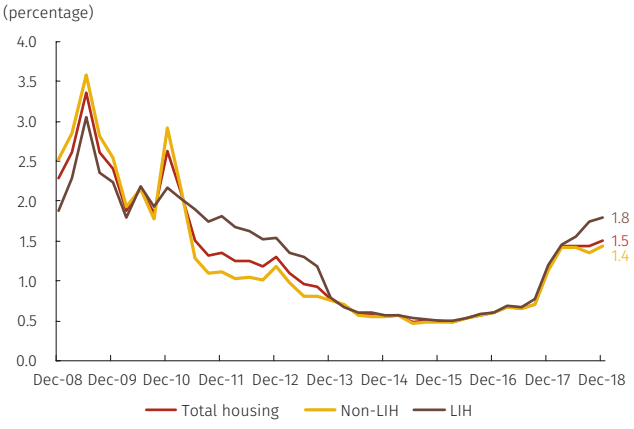
Source: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República.*

In addition, the RPIR and the weighted indicator for migrating to a worse rating for the housing loan portfolio are analyzed.[25] The RPIR, in turn, saw a slight deterioration due to the performance of the LIH segment that, despite the corrections in its NPL, has registered increases in the perception of risk. However, the RPIR remains below the historical peaks seen in 2009 (Graph 2.20).

In line with the above, the weighted indicator of migrating to a worse rating exhibited a growth trend over the last year (Graph 2.21). Deterioration has been seen in both the LIH and non-LIH segments although the trend is not homogeneous. On the one hand, there was a higher level in

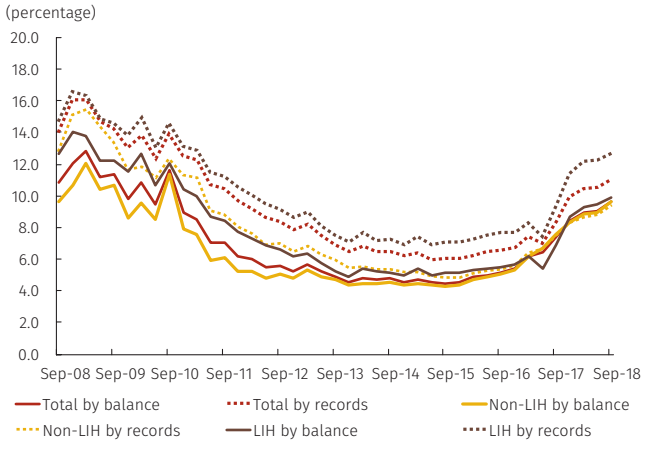
25 For the consumer loan portfolio, both indicators registered stable performance. Because of that, they are not presented in this edition of the *Report*.

Graph 2.20
Risk perception indicator by rating



Source: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República.*

Graph 2.21
Weighted indicator of migrating to a lower rating



Source: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República.*

the indicator for LIH per number of loans registered which indicates that loans for larger amounts in this segment are not as likely to migrate to worse ratings as the loans for smaller amounts. On the other hand, the indicators for non-LIH loans have shown almost identical results per number of loans registered and by balance which indicates that, on average, all of the loans have presented displacements of the same magnitude.

The debt-service ratio (DSR),[26] defined as the ratio of interest payments and amortizations to income, continued to show a decrease and as of November 2018 it stood at 15.4%. Of this percentage, the DSR associated to consumer loans is 13.4% while the remaining 2.0% corresponds to housing loans. Nevertheless, when the DSR of only indebted households is analyzed, the indicator has remained stable over the last year and, as of November 2018, it stood at 22.0% (Graph 2.22, panel A). The change in the indicators was mainly the result of a higher growth in income with respect to the monthly installment (Graph 2.22, panel B).

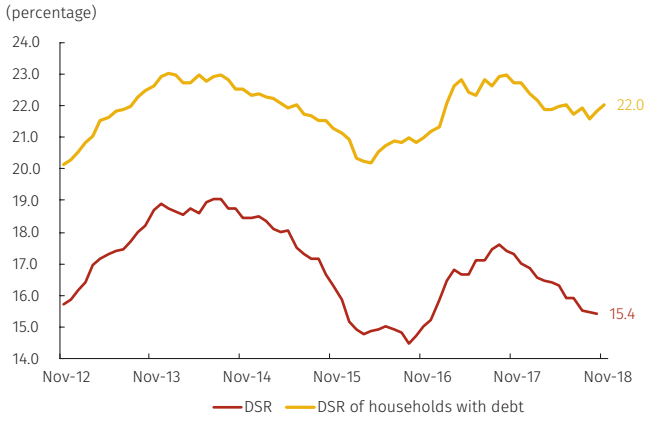
According to the information from the IEFIC survey, the financial burden on households has declined due to a better income compared to monthly installments.

By income quintiles, it can be seen that the DSR has registered declines for all households during the last year though to a lesser extent for higher-income households (Graph 2.23, panel A). In contrast, the only-indebted indicator registers a stable performance for all quintiles with the exception of the lower income one, which is consistently higher and as of November 2018 reached its highest historically available level (27.7%; Graph 2.23, panel B).

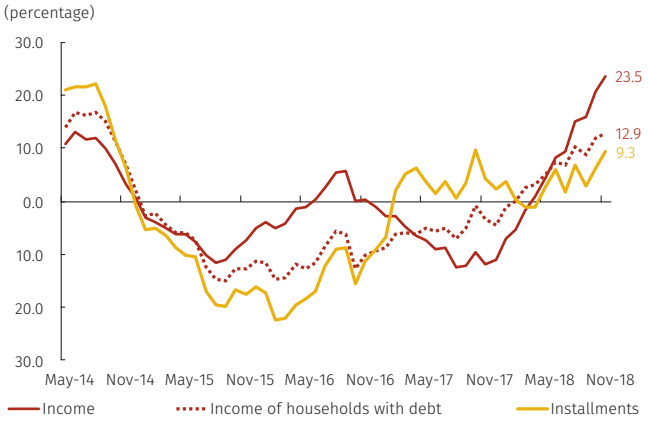
26 This indicator is built based on the information from the survey of financial burden and financial education (lefic in Spanish) prepared by *Banco de la República* and DANE. The indicator is constructed using a moving average of 12 months, given its volatility.

Graph 2.22
Debt-Service-Ratio (DSR)

A. Annual moving average



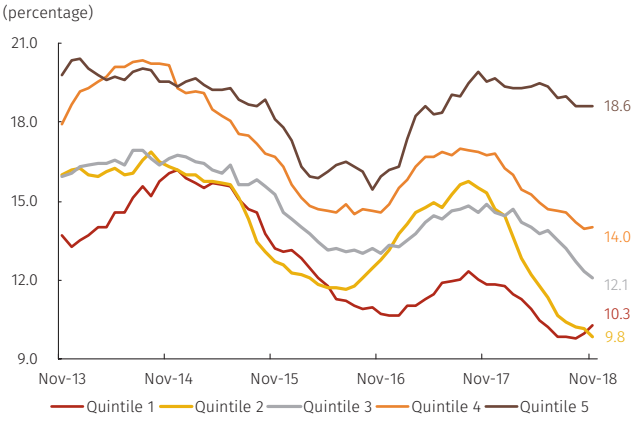
B. Real annual growth of components



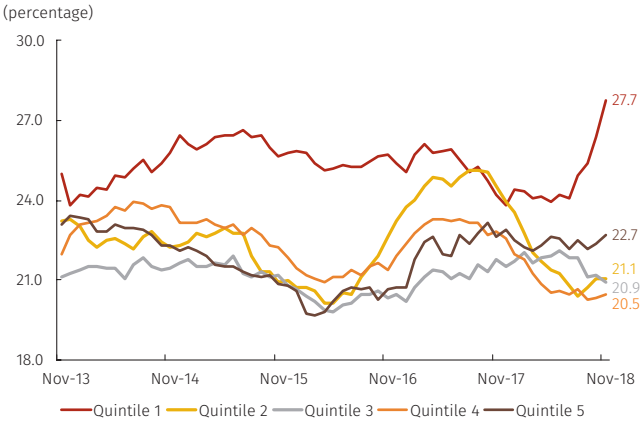
Source: *Banco de la República* and DANE.

Graph 2.23
DSR by income quintiles

A. All Households



B. Indebted households



Source: *Banco de la República* and DANE.

2.3 Market Risk

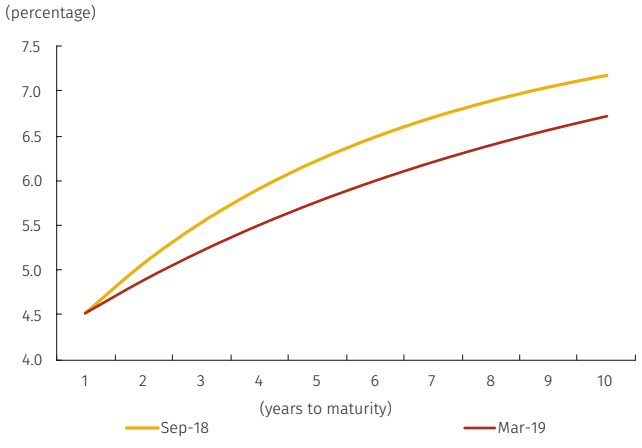
Public debt in pesos appreciated. The curve of UVR-denominated securities, in turn, depreciated in the short and medium tranches.

Between September 2018 and March 2019 there was a flattening of the yield curve of the peso-denominated bonds due to an appreciation in the medium and long part of the curve. This occurred, in part, because of an increase slower-than-expected in the Fed's interest rates and changes in the tax rate on foreigners' portfolio investments (Graph 2.24, panel A). In addition, the performance of inflation led to a slight devaluation of the UVR-denominated securities, primarily in the short and medium portions. The yield curve of UVR-denominated securities showed a slight rise in the short and medium terms while the 10-year rate remained unchanged after inflation expectations fell between September 2018 and March 2019 (Graph 2.24, panel B).

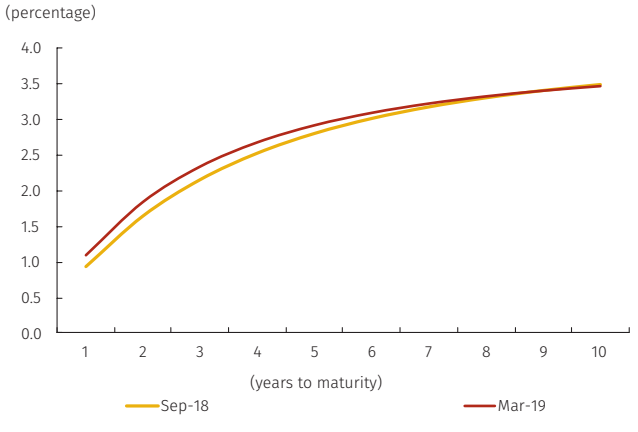
The improving performance of inflation over the course of the year is reflected in a change in expectations of an increase in the benchmark

Graph 2.24
Zero-coupon TES Curve

A. TES in Colombian pesos



B. TES in UVR



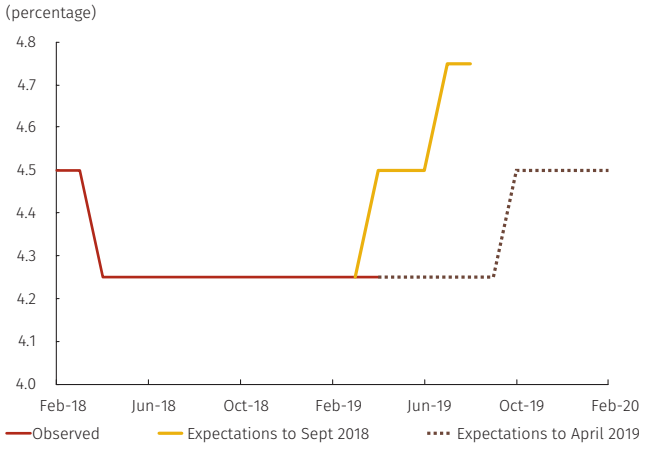
Source: Infovalver, calculations by *Banco de la República*.

rate. While two 25 bp increases were expected during 2019 according to a survey of the expectations of economic analysts that was done by *Banco de la República* in September of last year, only one raise is expected in October at this time (Graph 2.25). That is why greater depreciation in this market is not expected from a more tighten monetary policy in the short term. A similar performance is expected for the private debt market since that market maintains a high correlation with the peso-denominated TES market.

In the meantime, the variable income market registered significant fluctuations during the period under analysis. This led to the volatility of Colcap remaining at high levels.

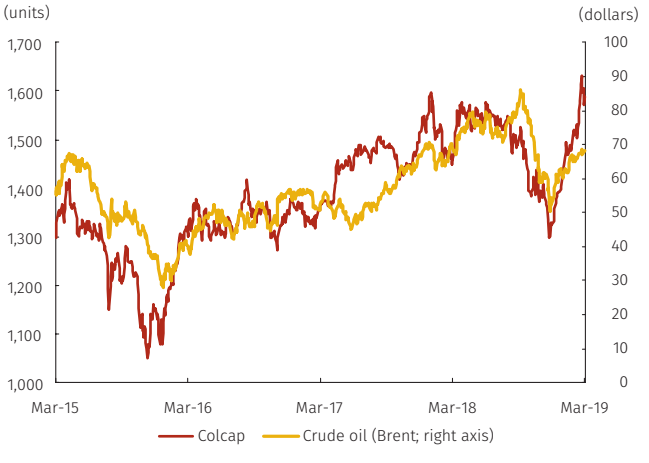
The variable income market price, measured by the Colcap index showed an appreciation of 5.4% between September 2018 and March 2019 (Graph 2.26). However, this increase was not homogeneous throughout the six-month period. Between September and October there was a fall in the stock index and it reached its lowest point in two years. In November 2018, a recovery process started in which the Colcap appreciated 14.0%. These fluctuations were mainly due to the performance of petroleum prices. These fluctuations had a direct impact on the price of Ecopetrol shares (the period in which the fall occurred coincided with a 40.6% drop in the price while the rise was accompanied

Graph 2.25
Policy Interest Rate Expectations



Source: Monthly survey of economic expectations, calculations by *Banco de la República*.

Graph 2.26
Behavior of Colcap



Source: Bolsa de Valores de Colombia (Colombian Stock Exchange).

by an increase of 35.5%). Moreover, the good results seen in the financial sector propelled the appreciation of its stocks. This also contributed to the recovery in recent months (Table 2.2).

Due to the index performance over the course of the period, there was a rebound in the volatility[27] of this market during the first few months in 2019 and it is remaining at values that are similar to those registered at

Table 2.2
Breakdown and Composition of the Colcap Index

Sector	Share (percentage)	Appreciation[a/] (percentage)
Consumption	9.0	4.4
Energy	14.4	-14.8
Finance	46.7	15.4
Industrial	0.6	-10.1
Raw Materials	13.8	4.9
Utilities	15.4	14.1
Communications	0.1	-14.4

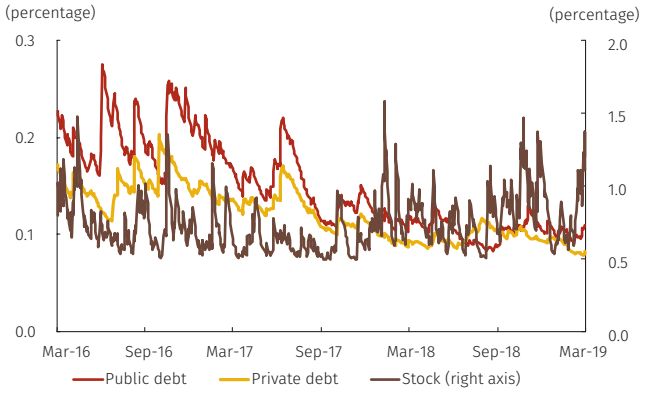
a/ Between September 28, 2018 and March 29, 2019
Source: Bolsa de Valores de Colombia (Colombian Stock Exchange) and Bloomberg; calculations by *Banco de la República*.

the end of the 2018 (Graph 2.27). This rise implies a higher market risk due to the increased uncertainty in the prices for these assets. Meanwhile, the volatility in the prices of private and public debt securities remains at low levels. However, there was a slight increase in the public debt indicator.

The main exposure to market risk on the part of the financial entities is concentrated in fixed income.

Exposure to fixed and variable income markets measured as an investment in securities exposed to market risk[28] is concentrated in the fixed income securities where the government bond market represents the largest share. However, the insurance companies have a higher investment in private debt securities which is why the NBFI aggregate shows a high exposure to this market. With regards to CIs, the highest share is found in the public debt

Graph 2.27
Conditional Volatility of Fixed income and stock Markets



Source: Bolsa de Valores de Colombia (Colombian Stock Exchange) and Infovalmer; calculations by *Banco de la República*.

27 Volatility is calculated using a GARCH model (1.1). In the case of variable income, the daily returns of the Colcap index were used, whereas the daily differences in the first main component of each curve were used for fixed income.

28 This balance is at market prices and is calculated according to the guidelines of the Basic Accounting and Financial Circular. The balance in shares was analyzed for the equity instruments of domestic issuers while, for debt securities, the ones that are marketable and available for sale were analyzed.

market with banks being the type of institution which has the highest investment in these kinds of securities (Table 2.3).

Should future risks materialize, they could affect the financial health of the system. For one thing, there are latent vulnerabilities in fiscal matters which could lead to a reduction in the sovereign rating and, thus, an increase in the risk premia. Consequently, risks coming from the persistence of the country's twin deficits could translate into a lower valuation of the securities. These risk factors will be considered in the stress test presented in chapter 3 of this *Report*.

Table 2.3
TES (in Colombian pesos and Real Value Units, UVR), Private Debt Securities, and Stocks Exposed to Market Risk

Type of institution	TES[a/]	Private debt	Stock	Total	TES	Private debt	Stock	Total
	(Balance in trillions of Colombian pesos)				(Percent change in the last six months)			
Credit institutions	47.32	4.78	9.49	61.59	8.48	19.06	39.55	13.14
Commercial banks	44.63	4.49	0.00	49.12	10.40	21.79	0.00	11.35
Financial corporations	2.65	0.19	9.49	12.34	-14.44	-11.96	39.57	21.90
Financing companies	0.04	0.06	0.00	0.11	-59.05	-6.35	3.75	-37.33
Financial cooperatives	0.00	0.03	0.00	0.03	0.00	-21.87	0.00	-21.87
Non-banking Financial Institutions	10.05	12.23	6.25	28.52	19.18	4.89	2.77	9.00
Pension fund managers: proprietary position	0.13	0.62	0.10	0.84	54.75	-2.45	-13.91	1.71
Stock brokerage firms: proprietary position	1.54	0.20	0.22	1.97	-14.23	22.06	12.68	-9.02
Trust funds: proprietary position	0.25	0.37	0.84	1.45	9.63	64.03	0.20	12.89
Insurance Companies	8.13	11.04	5.09	24.25	28.58	3.83	3.18	10.83
System: proprietary position	57.37	17.00	15.74	90.11	10.21	8.52	22.19	11.80
Third-party Position								
Stock brokerage firms: third-party position	1.15	10.59	7.20	18.94	4.72	3.71	9.77	6.00
Trust companies: third-party position[b/]	109.12	43.15	21.97	174.24	9.21	1.54	-53.41	-8.09
System	167.65	70.73	44.91	283.29	9.52	3.46	-32.56	-1.65

a/ The value of the proprietary position is obtained from "Investment Portfolio" on format 351 while the value of the managed position is obtained CSD data.
b/ Does not include pension liabilities managed by trust companies.
Sources: Central Value Deposit (DCV), Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República*.

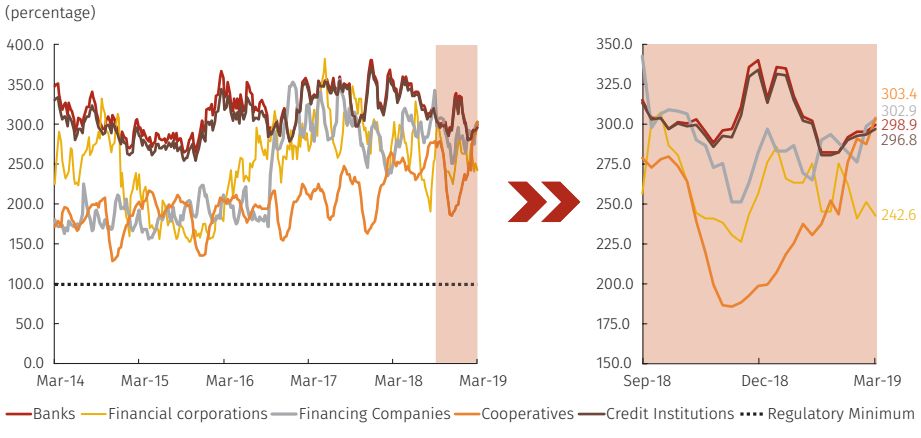
2.4 Liquidity Risk and Banking Book Interest Rate Risk

2.4.1 Liquidity Risk

Cis' short-term liquidity, measured by using the 30-day liquidity risk indicator, stood at levels which were similar to those observed six months earlier despite the fluctuations registered during that half year.

As of March 22, 2018, the aggregate liquidity of the CI measured by the SFC's thirty-day liquidity risk indicator registered levels similar to those seen in September 2018. Although a mixed performance was seen by type of institution throughout the period, the LRI, in all cases, is high with respect to the regulatory minimum (Graph 2.28).

Graph 2.28
Weighted Average 30-day Liquidity Risk Indicator (LRI) for CIs[a/]



a/ Average that gives greater weight to the most recent data.
Source: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República*.

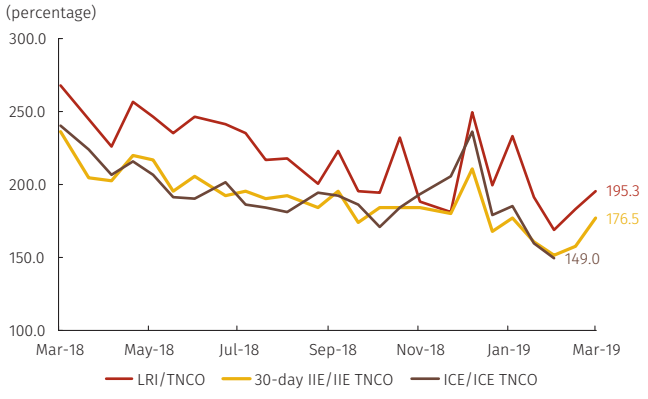
Like the LRI, the indicator of individual short-term exposure remained relatively stable; however, the consolidated indicator registered a decline.

When assessing the liquidity of the institutions based on the indicators of individual (IIE) and consolidated exposure (ICE)[29], as a percentage of the corresponding net liquidity requirements (NLR), during the last six months it was observed that the 30-day IIE of the CI that are foreign exchange market intermediaries (FXMI) and do not consolidate represented, on average, 1.7 times the total NLR. The CI that are FXMI and consolidate balance sheets in accordance SFC instructions, in turn, registered an ICE[30] as a percentage of the NLR lower than the one registered six

29 The and the indicators allow to measure the liquidity risk of the foreign exchange market intermediaries (FXMI) by currency over a horizon of 30 days. For more information on the calculation of these indicators see *Banco de la República*'s External Regulatory Circular DODM-361.

30 As of the publication date of this Report, ICE data with a cut-off date of February 02, 2019 were available.

Graph 2.29
Short-term Liquidity Indicators as a Percentage of Total Net Cash Outflows



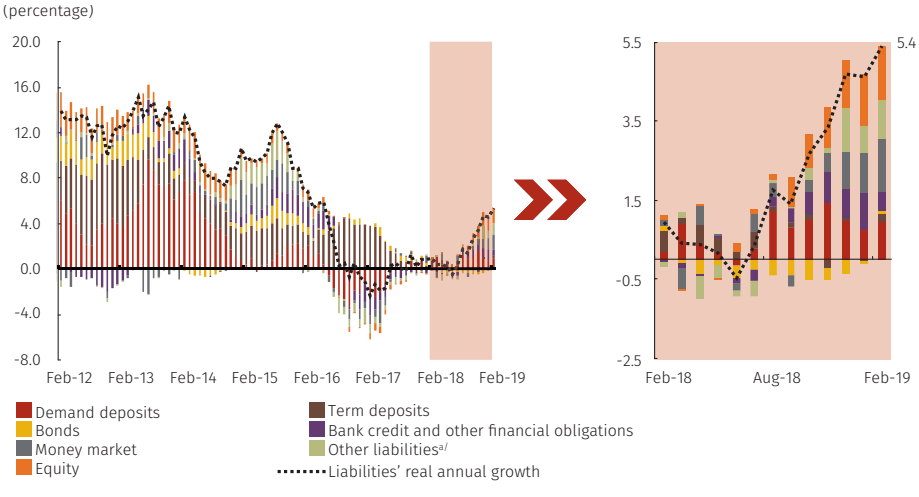
Source: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República.*

months ago, continuing the decreasing trend it has exhibited since late 2018 (Graph 2.29).

In line with the CIs' assets dynamics, the stagnation that the funding had been showing since mid-2017 reversed and registered the highest rate of growth since 2016.

In terms of structural liquidity, during the past year the funding of CIs (liabilities plus equity) continued its recovery, recording growth rates that had not been observed since the beginning of 2016. At the date of analysis, all items presented positive contributions to the growth of funding, especially those associated with equity, the money market and demand deposits (Graph 2.30).

Graph 2.30
Credit Institution Liabilities, Annual Real Growth and Component Contribution

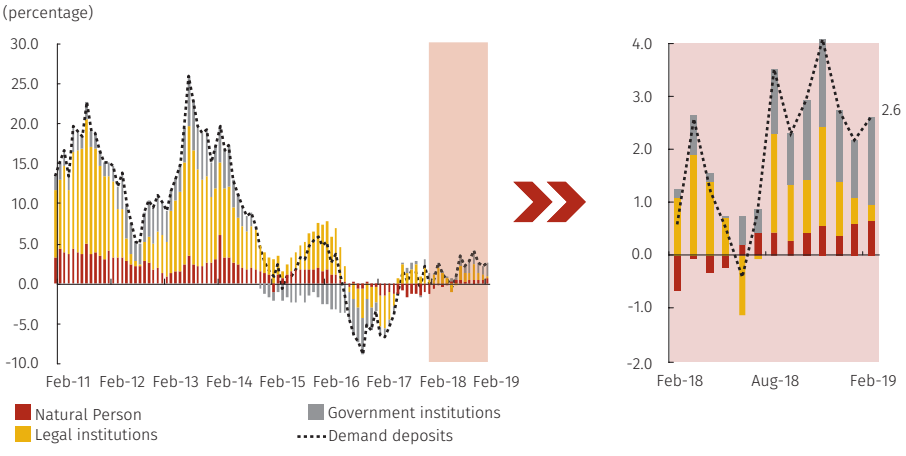


a/ other liabilities correspond to: outstanding acceptances and derivatives, capital contributions, banks and correspondents, bonds convertible into shares (Bocas for its Spanish acronym), bonds mandatory convertible into shares (Boceas for its Spanish acronym), Term savings certificates (CDAT for its Spanish acronym), accounts payable, electronic deposits, affiliate establishments, other deposits and current liabilities with and without amortized cost, labor obligations, provisions and collection services.
Source: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República.*

Consequently, demand deposits in the CIs continued to register greater strength, which was explained by a recovery in the deposits of official entities.

Demand deposits, which represent 41.1% of the CI liabilities, registered a real annual growth rate of 2.6% as of February 2019. With respect to what was observed six months ago, the recovery of this item was supported by the larger contribution from all the agents' deposits, primarily those from official institutions (Graph 2.31).

Graph 2.31
Demand Deposits' real annual growth and Contribution by Counterparty



Source: Office of the Financial Superintendent of Colombia, calculations by *Banco de la República.*

2.4.2 Banking Book Interest Rate Risk

The structure of the interest rates in the CI balance sheets is analyzed in this section as well as their exposure to banking book interest rate risk.[31] The measurement of this risk seeks to estimate how changes in the interest rates for assets and liabilities affect net interest income.

The share of assets and liabilities contracted at a variable rate has stabilized in the last six months.

Between September 2018 and March 2019, the downward trend of the share of the CI variable interest rate assets that has been registered since the beginning of 2017 halted and remains below the share of assets at fixed rates. Likewise, although the variable interest rate liabilities as a share of the assets rose at the end of 2018, in March 2019 they stood at levels similar to the ones they had registered six months earlier (Graph 2.32).

Regarding the structure and components of the balance sheet accounts agreed upon variable interest rates, the asset positions indexed at the benchmark rates are more relevant than the ones associated with inflation32 which is the opposite of what happens with liabilities contracted at variable interest rates (Graph2.33).

31 The interest rate risk has two dimensions: the first is analyzed in the section on market risk and refers to the risk of devaluations of the assets on the trading book in the event of interest rate movements; the second, which is analyzed in this section, corresponds to changes in the net interest income caused by interest rate changes, considering the information from the banking book.

32 The benchmark rates correspond to DTF and BBI while those associated with inflation are the UVR and CPI.

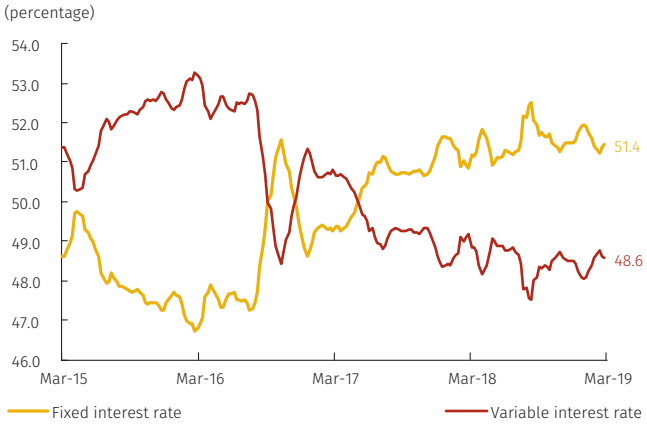
The exposure to trading book interest rate risk measured by the WATM gap has remained stable over the last six months.

The *weighted average term to maturity* (*WATM*) gap was calculated in order to measure the exposure of the banking book to interest rate risk. This is defined as the difference between assets and liabilities that are sensitive to changes in interest rates for different periods. When this indicator takes on negative values, it means that an increase of the same magnitude in lending rates and deposit rates would generate a reduction in the net interest income. This measurement of interest rate risk depends primarily on two factors: the proportion of assets and liabilities contracted at variable interest rates and the term to maturity of fixed-interest rate assets and liabilities.[33]

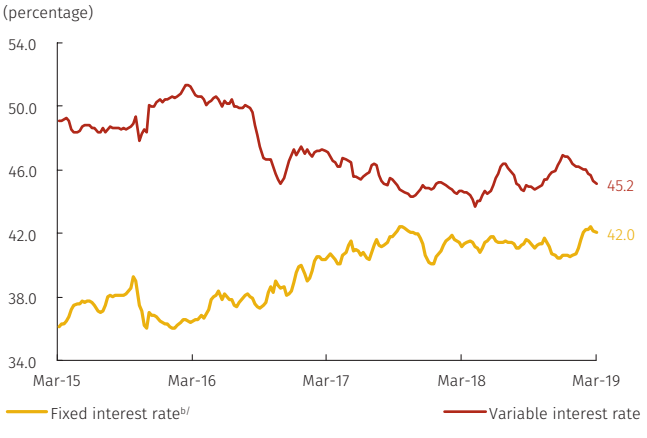
The indicator has negative values for all the time horizons analyzed. Based on the structure of the interest rates on the balance sheets, the *WATM gap* registered stability for all of the maturities analyzed (Graph 2.34).

Graph 2.32
Evolution of assets and liabilities by type of interest rate[a/]

A. Assets



B. Liabilities

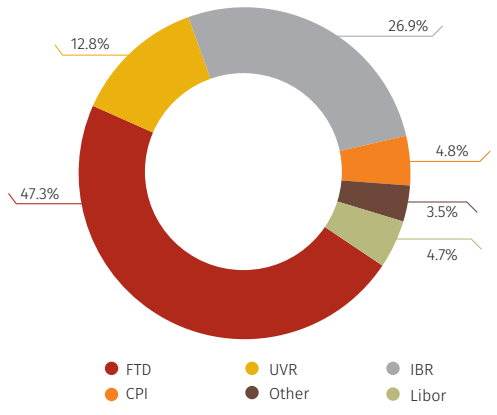


a/ Liabilities at fixed and variable interest rates are presented as a share of the total assets.
b/ The amount of liabilities at fixed rate incorporates demand deposits of individuals while the demand deposits of legal institutions and government institutions are included in the liabilities contracted at variable rates.
Source: Office of the Financial Superintendent of Colombia (FSC); Calculations by *Banco de la República.*

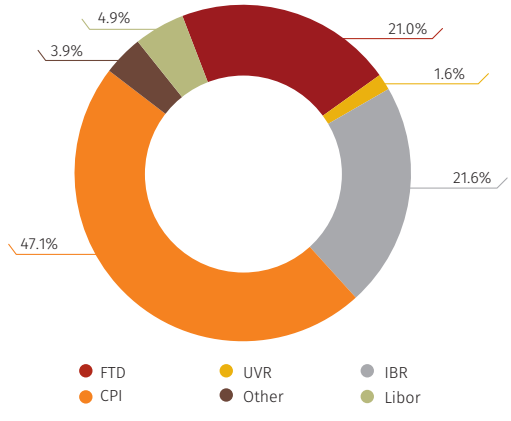
33 For more detail on the calculation of the WATM Gap, see the box "Interest Rate Risk of the Colombian Credit Establishments' Trading Book" in the September 2015 *Financial Stability Report.*

Graph 2.33
Breakdown of the Variable Interest Rate Assets and Liabilities by Type of Interest Rate, March 2019

A. Assets



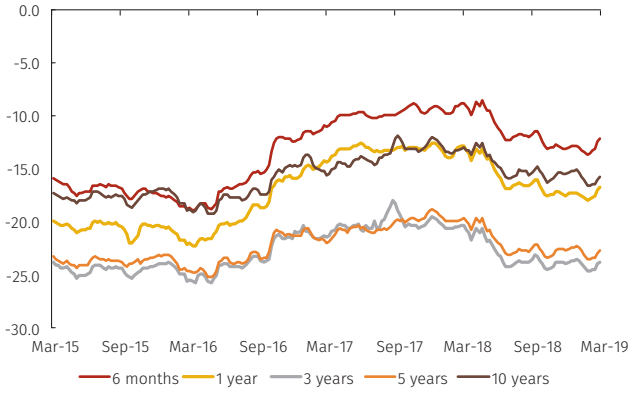
B. Liabilities



Source: Office of the Financial Superintendent of Colombia (FSC); Calculations by *Banco de la República.*

Graph 2.34
WATM Gap

(percentage on assets[a/])



a/ These assets correspond to those that generate interest income.
Source: Office of the Financial Superintendent of Colombia (FSC); Calculations by *Banco de la República.*

Box 4
The Role of the Supervisor in the Reversal of the Recent Deterioration in the Loan Portfolio

Office of the Financial Superintendent of Colombia (SFC)*

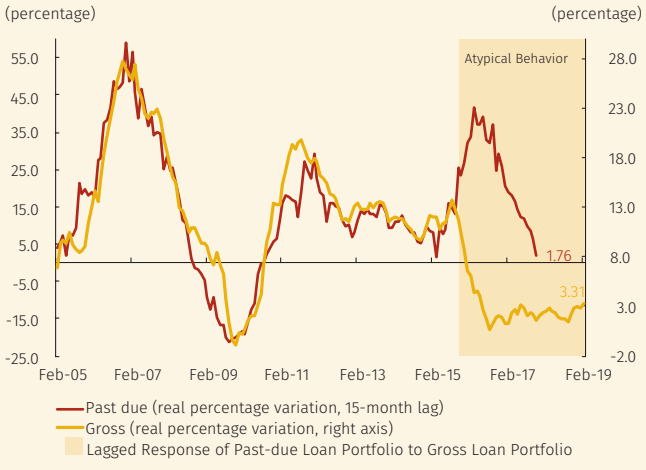
In 2017 the SFC introduced two monitoring strategies and a regulatory initiative in order to reverse the upward trend of the non-performing loan portfolio, which had become more accentuated since the end of 2016, and to reinforce a proper disclosure of credit risk. This box presents the rationale behind these strategies and evaluates their effectiveness based on the available evidence. The last section describes the supervisory approach with regard to credit risk that is being developed in 2019.

1. The Context of the Measures

Historically, the non-performing loan portfolio responded both directly and lagged behind the growth of the gross loan portfolio.[1] Nevertheless, since the end of 2015, there has been a breakdown in this relationship and, contrary to what was expected, the downturn in the gross portfolio did not translate into a comparable decrease in the deterioration (Graph B4.1).

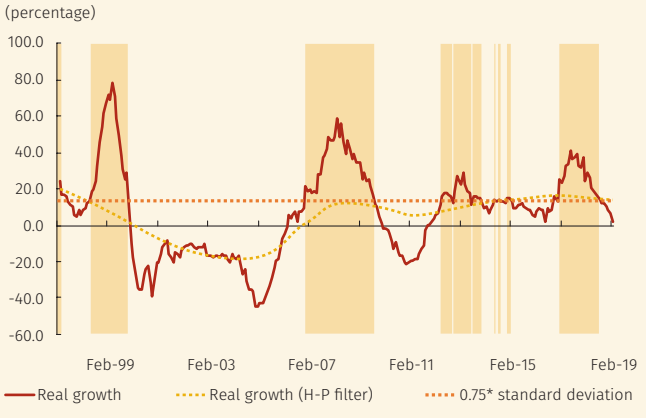
The disconnection, which still persists, was attributed to the effect of the supply shock experienced in 2014 and the drop in crude oil prices together with the idiosyncratic deterioration of some debtors who were heavily exposed.[2] In addition to this disparity between the growth rates of gross and non-performing loan portfolios, the latter departed from its long-term growth trajectory (shaded area[3] in Graph B4.2), a performance that was widespread among the different loans modalities.

Graph B4.1
Relation of Past-due Portfolio and Gross Loan Portfolio



Note: The optimal lag prior to the rupture was 15 months.
Source: Office of the Financial Superintendent of Colombia.

Graph B4.2
Activation thresholds: past-due loan portfolio



Note: lambda follows the Ravn and Uhlig rule (129600).
Source: Office of the Financial Superintendent of Colombia.

Starting with this diagnosis, the SFC designed two strategies, which were launched in July 2017. These actions were complemented by a regulatory initiative issued in September 2017.

The first strategy, which was geared to reverse the trend towards deterioration within a reasonable time frame, was based on rapprochements with thirteen institutions whose past-due portfolios were showing signs of systematic deviations from their long-term growth trajectory under the thresholds established. The dissemination made it possible to raise the awareness of the institutions with respect to the atypical nature of this performance while, at the same time, they were formally required to design and submit a

* The opinions presented herein do not compromise *Banco de la República* nor its Board of Directors.

1 FSC (2011) Notes from the Supervisor No. 001. *The growth of credit and its impact on the non-performing loan portfolio: a direct and lagged relationship.*

2 *Electricaribe and Ruta del Sol II.*

3 The activation threshold for deviation with respect to the trend (shaded area) combines three simultaneous events: positive growth of the past-due portfolio that is higher than its long-term trend and greater than 0.75 times its standard deviation.

plan of action with corrective measures for each of the credit cycle phases.[4] After the plan was approved, a period of observation started in which the effectiveness of the plan in furthering a gradual convergence of the past-due loans with the channel of targeted individual growth was evaluated. In the case that the deviation persisted, the SFC would invoke its authority to request a reinforcement of the capital or impose restrictions on the distribution of profits at the end of the accounting period.

The second strategy, which calls for the proper disclosure of the risk of the commercial loan portfolio, is based on an internal rating that generates warnings after data on indebtedness and loan portfolio quality are compared to the debtor-level financial information provided by the Superintendent of Corporate Affairs and Economic Solidarity. Within the framework of this strategy, which involved 17 institutions between 2017 and 2018, working groups were set up to discuss the findings and promote better risk disclosure practices. In addition to the periodical updating of the rating, the financial situation of the debtors linked to the mass transportation and residential building subsectors was evaluated for the eight institutions with the most exposure to these subsectors.

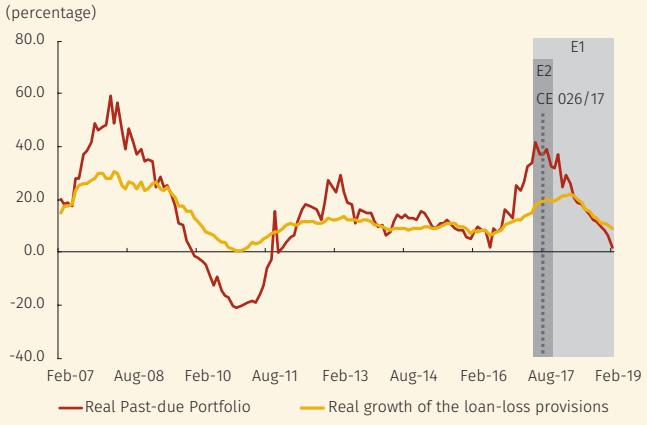
To supplement this, External Circular 026/2017, which focused on maximizing the recovery, was issued. This norm introduced innovations on five fronts: i) the formalization of the concept of early default[5]; ii) the difference between structural (restructuring) and circumstantial (modification) deterioration; iii) the homogenization of practices that hid standardization[6] to avoid signaling restructuring; iv) the adoption of special monitoring periods; and v) the inclusion of strict requirements in the case of failure to comply with the new conditions.

2. The Balance of the Measures

The gradual return of the non-performing portfolio to its long-term trajectory and the strengthening of the process of risk disclosure confirms the effectiveness of the measures taken (Graph B4.3).

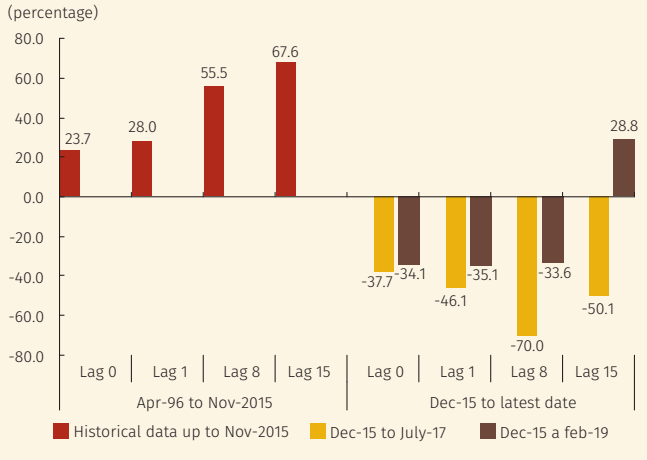
In addition, the estimates show that, even though the disconnection between the gross and non-performing still persists, the present relationship has lost strength and, in its place, the optimal lag that had traditionally been seen

Graph B4.3
Implementation of the Measures vs. Real Growth of the Non-Performing Loan Portfolio and Loan-loss Provisions



Note: Ei: Strategy 1 or 2. The width of the bars denotes the period that the strategy was in effect.
Source: Office of the Financial Superintendent of Colombia.

Graph B4.4
Correlation Between Non-performing and Gross Loan Portfolios for Different Periods in the Sample



Source: Office of the Financial Superintendent of Colombia.

has once again evinced a direct response though it still is not statistically significant (Graph B4.4).

Regarding the first strategy, eleven of the thirteen institutions that had to submit a plan of action experienced a correction and/or adjustment in the growth of the past-due portfolio to its long-term trend in late 2017.[7] In general, the measure did not cause substantial changes in the past due loan policy. In place of it, the common denominator of the plans was centered around reinforcing the policies adopted over the course of the credit cycle. Regarding origination, the adjustments in the appetite for risk, the policies of approval and profiling, and improvements in gauging

4 Origination, follow-up, and recovery.

5 Those debtors who do not have consecutive defaults of more than 60 days during the last 6 months for the microcredit and consumer portfolio, and of more than 90 days for the commercial and housing ones. The equivalent for the European Banking Authority (EBA) is the recent non-performing loans (up to 90 days past due).

6 Such practices received different names such as "novations", refinancing, etc.

7 In one case, the SFC ordered that the historical percentage of retained earnings be maintained and, in another, that a specific percentage of minimum capital adequacy be maintained.

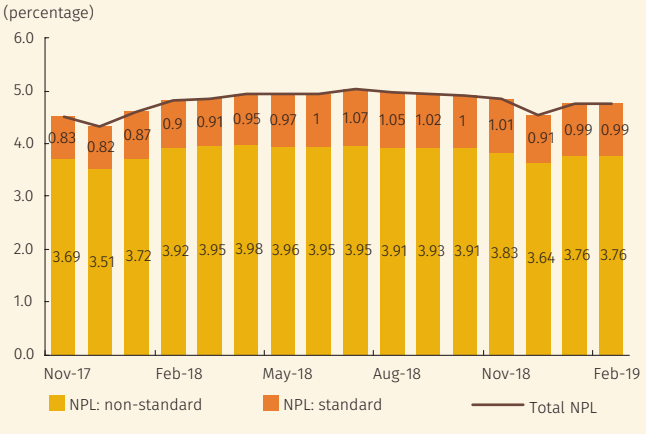
creditworthiness are notable. In follow-up, the analysis of the debtor's habits was strengthened. The better recovery reflects the development of models of default prevention management which include undertaking regional brigades.

The combination of warning plans and sector analyses in the second strategy that was geared towards strengthening the risk disclosure processes led to almost COP 760 billion in increases in loan-loss provisions between 2017 and 2018.

The major contribution of the regulatory initiative was the standardization of recovery practices and alignment of consumer and institution incentives. However, the main challenge was to evaluate its effectiveness through objective indicators.

From the time it went into effect until February 2019, the balance of the standardized loan portfolio reached COP 21.5 trillion,[8] of which COP 4.12 trillion correspond to modifications. During this same period, the rate of success, i.e., the modified and restructured balance that remains up-to-date in comparison to the standardized total exceeds 74%. As a result, the contribution to the quality indicator by default of the transactions for which standardization was flawed has remained relatively stable at about 1pp (Graph B4.5).

Graph B4.5
Non-Performing loan indicator (NPL)



Source: Office of the Financial Superintendent of Colombia.

In addition to these figures, the Circular has encouraged improvements in credit establishments' risk management with positive effects for the consumer. At the level of industry, the regulations caused synergies between the origination and recovery functions as well as reinforcement of the follow-up infrastructure for these transactions. The transition from an industrialized approach to a "relational" one, in turn, made it possible for the consumers to decide when to approach the institution to discuss their difficulty in meeting their financial commitments and provide evidence to show their ability to comply with the new terms of payment.

3. What is the Focus for 2019?

It is undeniable that the adoption of the measures described led to the achievement of the objectives set. However, there are factors inherited from 2018 that could exacerbate credit risk in 2019. In particular, the growth of the loan portfolio has been based on households given the persistent contraction of the commercial loan portfolio.

The above suggests that the incentives are given so that the institutions will venture into higher risk niches and into segments in which they may have less experience. That is why monitoring in 2019 with regard to credit risk is defined on two axes: i) foster healthy growth of the loan portfolio and ii) reinforce the achievements of the disclosure strategy.

With regards to origination, the SFC designed early warning indicators based on the performance of the static pools. These measures, differentiated at the level of institution and product, analyze the permanence, the emergence and direction of: 1) the unusual growth of disbursements, and 2) the material deviations with respect to the historical performance of quality by static pool in three- and six-month time frames.[9] Depending on the type of warning (disbursements and/or early deterioration) and its persistence over time, the institution's specific situation is specified and if necessary, adjustment plans are established. The measure is preventive in nature in that it identifies the cause of the deterioration and suggests its timely adjustment.

Regarding disclosure, the SFC will continue to move ahead on their efforts to ensure that the rating granted by the institutions is consistent with both the situation in the sector and the debtor's financial situation.

Finally, as part of the plan for Risk-based Supervision, the SFC will remain alert to the emergence of new risk factors that could jeopardize the stability of the institutions being monitored and will design strategies they deem prudent to adopt in order to mitigate them.

8 Of this total, 62% corresponds to commercial, 28% to consumption, 7% to housing, and 3% to microcredit. In line with the effect of the cycle on the activity, the sectors that accounted for the standardized balance were construction (22%), industry (16.5%), and transportation (11.2%).

9 This time frames makes early detection of deviations in quality possible. It was considered to take the average, maximum, and minimum per entity and per product in a moving time horizon of four years. Subsequently, two warning zones were defined: orange (one standard deviation above the average) and red (between one standard deviation and the worst static pool indicator).

Box 5

An Analysis of Financial Vulnerability using the Heuristic Method

José Hernán Piñeros-Gordo*

The test proposed by Aikman et al. (2014) as an early warning mechanism of financial vulnerabilities in the credit establishments (CIs) is duplicated in this Box. This test combines *cluster* techniques (to classify the CIs into homogeneous subgroups), methodologies for calculating financial indicator thresholds, and a fast and frugal decision tree on financial vulnerability in order to predict the individual financial situation of each CI. The method used is heuristic inasmuch as it consists of a simple rule that omits part of the information available in order to make inferences about the future performance of the institutions.[1] The results obtained with the tree methodology suggest its potential to be used as an early warning mechanism for the CIs in Colombia.

1. Definition of Financial Vulnerability and Breakdown of CI Subgroups

In order to establish any kind of early warning mechanism of financial vulnerability, it is essential to specify what is meant by the latter. In this Box, an institution was considered vulnerable if it experienced any of the following events at any point between 2014 and 2016: 1) Resorting to transitory liquidity support from *Banco de la República*; 2) being into special monitoring, capitalization plans or adjustment plans ordered by the Office of the Financial Superintendent of Colombia (FSC), and 3) needing to carry out voluntary clearings authorized by the FSC. The CIs are summarized by the kind of financial intermediaries that were identified as vulnerable at some point during the period under analysis in Table B5.1.

Table B5.1
Number of Fragile and Non-Fragile CIs

Period	CI	Banks	FC	FCs	FCo
Total CI (December 2013)	54	23	21	5	5
Vulnerable (2014-2016)	8	1	7	0	0

Sources: Office of the Financial Superintendent of Colombia and *Banco de la República*.

Additionally, given the heterogeneity of the CIs in the Colombian financial system, it is essential that the methodology be applied separately to subgroups of CIs that are relatively homogeneous in their financial intermediation business in order for it to be successful. The cluster approach,[2] which made it possible to classify the ECs into four groups, was used for this. Group 1: twenty-seven CIs —seven small banks,[3] fifteen finance companies (CFC) and five financial cooperatives (FCO)—; of these, one bank and three CFCs experienced situations of financial vulnerability. Group 2: Five CFCs; of these, four were financially vulnerable. Group 3: fifteen CIs (fourteen banks and one CFC); in this group, none showed a state of financial vulnerability. Group 4: six CIs (one bank and five financial corporations -FC), none of which showed evidence of financial vulnerability. Given that, between 2014 and 2016, there were no CIs that met the characteristics of institutions with financial vulnerability as defined in this study for groups 3 and 4, it was necessary to resort to a statistical procedure to identify institutions that were vulnerable in each one of these groups.[4] For group 3 there were three financially vulnerable banks and for group 4, only one.

* The author works in the Financial Stability Department of *Banco de la República*. The opinions expressed here are the sole responsibility of the author and do not imply any commitment on the part of *Banco de la República* or its Board of Directors. The author would like to thank Linda Mondragón for her valuable contribution to this box as well as Felipe Clavijo and Santiago Gamba for their collaboration in applying the Cluster approach and minimizing the loss function to find some of the thresholds for the groups of credit institutions..

1 According to Gigerenzer et al. (2009) the heuristic fast and frugal tree methodology is also characterized by its transparency and simplicity. Indeed, these processes, which are based on experience in problem-solving and seeing how others solve them, are usually precise, clear, and non-complex. They are also robust in their results in spite of the changes in the environment.

2 This approach was carried out while considering: i) financial deposit structure (CD/deposits and deposits/assets); (ii) allocation structure (loan portfolio/assets, investments/assets, and cash available/assets), and iii) market niche characterized by its administrative and labor expenses as well as its gross financial margin (administrative and labor expenses/assets, and gross financial margin/assets). Information in the financial statements of CIs as of December 2013 was used for this.

3 Each one had less than 1% of the total banking system assets.

4 The ad hoc statistical procedure consisted of: a) all of the financial indicators to be assessed were standardized by applying a transformation to make them take values between zero and one; b) These indicators were grouped into five categories: capital adequacy, profitability, liquidity, efficiency, and credit risk. For each category a variable was calculated as the average of the transformed indicators belonging to that category; c) the indicators of efficiency and credit risk were lined up in the same direction of vulnerability as the remaining indicators (multiplying by -1) and, therewith, a simple average was calculated for the five categories in order to obtain a single indicator of vulnerability per entity, and d) vulnerable institutions in groups 3 and 4 were identified by the subtraction of one standard deviation from the mean.

2. Financial Indicators Used

Just as Aikman et al. (2014) indicated, banks go bankrupt due to a variety of factors that have an impact on the financial performance of the financial system from various angles. This suggests that it is important to combine the information from different indicators including the institutions' financial and administrative management. Twenty-one indicators that cover six financial areas are used in this Box: banking capability, capital adequacy, liquidity, profitability, efficiency, and credit risk. The full list of indicators and their definitions or explanations are presented in Appendix 1.

3. Relevant Thresholds for Individual Financial Indicators

Using the Sarlin loss function methodology (2013) that was applied by Aikman et al. (2014), it is possible to find thresholds for each indicator from which they ideally predict a situation of financial vulnerability. These optimal thresholds minimize the loss function:

$$0.5 \times Pr\ (false\ alarm) - 0.5 \times Pr\ (success)$$

Where success corresponds to the case in which the indicator exceeded the threshold in December 2013 and the CI actually experienced vulnerability at some point between 2014 and 2016, and false alarm corresponds to the case in which the indicator surpassed the threshold in December 2013 and the CI did not experience vulnerability at any time between 2014 and 2016.[5] The probabilities are calculated by means of frequencies. This loss function reflects an equal weighting of false alarms and success. Thus, the smaller the loss, the better the indicator. A perfect signal would detect all the "bankruptcies" with Pr (success) = 1 and would not produce false alarms, thus giving a loss function of -0.5.

4. Fast and Frugal Tree (fast and frugal tree: FFT)

According to Aikman et al. (2014), based on the thresholds calculated for each individual indicator, it is possible to get a lower loss function value by means of the heuristic design of a fast and frugal binomial tree (FFT). The FFT consists of a single signal of vulnerability composed of various financial indicators (with previously calculated thresholds) arranged in "levels." The first indicator (level) is evaluated for each institution, and it is marked with a red exit flag if it exceeds the threshold (and consequently has a forecast of financial vulnerability) or, with a green exit flag if it does not so. In this way, the indicator may be evaluated at the next level or, if this is the last level, it can be given a sign of no vulnerability. The key to the method lies in the number of levels and their arrangement, which is done by expert judgment.[6]

Five indicators (signals) or levels were used for this exercise for each one of the CI groups, which were organized by the value of the loss function, while taking care to choose only one per financial area. The rest of the indicators for each group are not used in the tree. In Diagram B5.1, using this method, the chosen tree is illustrated with five levels (in yellow) for each group. Each level contains the threshold of the respective indicator (to the right of the name of the indicator) and, in parentheses, the value adopted by the loss function when it is minimized, and the result with regard to false alarms. For groups 1, 3, and 4, all levels reached a 100% success rates with an ascending false alarm rates. In other words, all of the vulnerable CIs were, in fact, predicted correctly, but the rapid rise in the rate of false alarms (especially for groups 3 and 4) suggests that the additional levels are not adding relevant information and, therefore, that a smaller number of levels could be desirable. In the case of group 2, the minimum value of the loss function was obtained on the five levels (-0.5) with a success rate of 100% and a false alarm rate of 0%. Theoretically, there could be an absolute certainty that, with this methodology, the CIs in this group would correspond to those that actually had experienced vulnerability between 2014 and 2016.

References

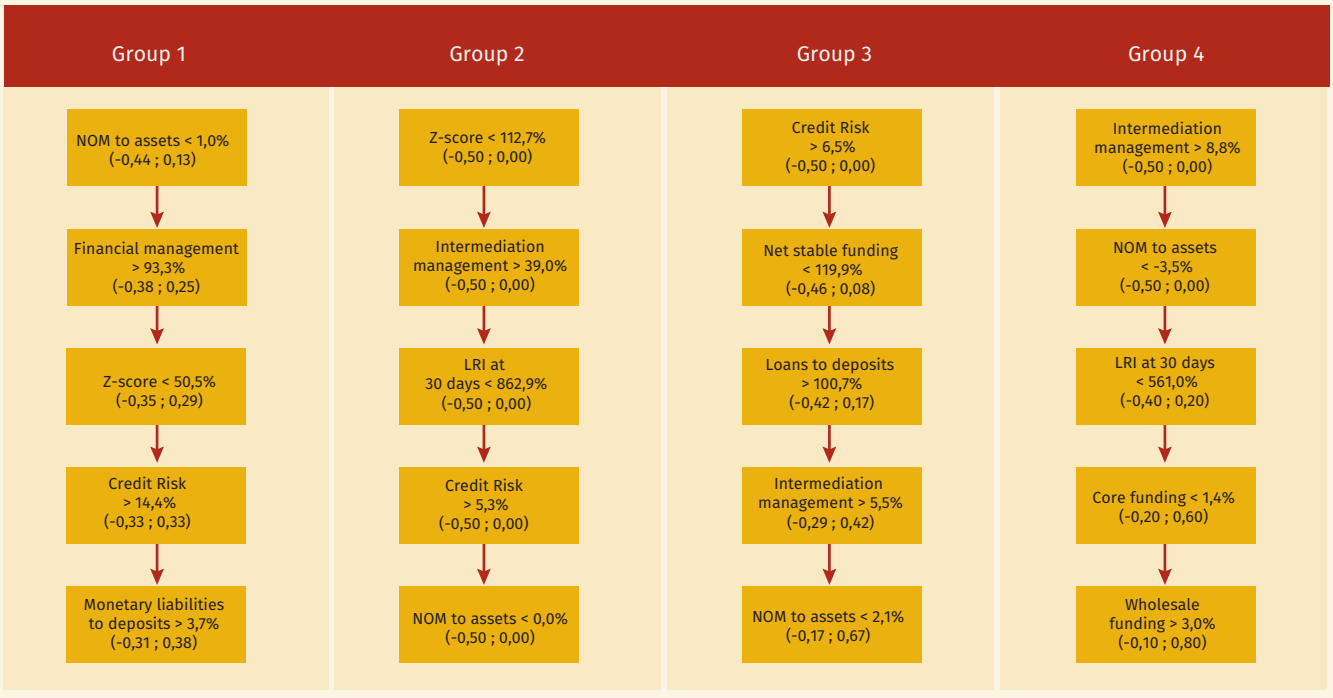
Aikman, D.; Galesic, M.; Gigerenzer, G.; Kapadia, S.; Katsikopoulos, K.; Kothiyal, A.; Murphy, E.; Neumann, T. (2014). "Taking Uncertainty Seriously: Simplicity versus Complexity in Financial Regulation", Financial Stability Paper, No. 28, May, Bank of England.

Gigerenzer, G.; Brighton, H. (2009). "Homo Heuristicus: Why Biased Minds Make Better Inferences," *Topics in Cognitive Science*, vol. 1, pp. 107-143.

5 In general, Pr (success) is the probability of success (success rate), and it captures the number of CIs that are correctly identified as subsequently going into "bankruptcy", given a cut-off threshold, compared to the total number of banks that actually did go bankrupt. Pr (false alarm) is the probability of error (false alarm rate), and it captures the number of CIs that are identified incorrectly as subsequently going into "bankruptcy."

6 If the levels were arranged randomly, a larger number of levels could trivially imply a greater probability of vulnerability due to the fact that each level represents an additional filter that the institutions would have to overcome.

Diagram B5.1
Financial Vulnerability Trees by Group of CIs



Source: Office of the Financial Superintendent of Colombia; calculations by the author.

Annex 1

A1.1 Banking activity

Annual growth of total assets
(*total asse*$_t$ - *total asse*$_{t-1}$) / *total asse*$_{t-1}$

A1.2 Sufficiency of capital to absorb those derived from the financial intermediation business

a. Z-score
   (*average ROA + RST*) / *DS ROA*
   Where *average ROA* is the average annualized return of assets, RST is the total solvency ratio, and *DS ROA* is the standard deviation of the *ROA* for the last twelve months to the date of the indicator.
b. Risk-based capital ratio (RST)
   Technical assets / risk-weighted assets
c. Capital-to-asset ratio Total
   technical assets/total assets
d. Bankruptcy
   Net equity / share capital
e. Liabilities equity
   leverage / net equity
f. Ratio of loans to deposits
   Loans Retail/retail deposits
   where *retail loans* are represented by gross consumer portfolio and gross home portfolio, and *retail deposits* are constituted as the difference between *total deposits* and *wholesale deposits*.

A1.3 Profitability

a. Capital profitability (ROE)
   net profit / average equity
   Net profit takes into account the cumulative flow side of that item in the last twelve months (annualized), and the *average equity* is equity corresponding to the balances of the last twelve months to the date of the indicator.
b. Net operating profitability
   MON / Average total asset
   Where *MON* is the net annualized operating margin. The MON is the sum between the non-financial MON and the MFB (see the following literal). The non-financial MON corresponds to operational income minus labor and ad ministerial expenses, less expenses for net provisions of recoveries. The *total average asset* is the balances of the last twelve months at the date of the indicator.

c. Gross financial return
MFB / average assets
Where the MFB is the difference between financial income and annualized financial outflows.

A1.4 Liquidity

a. Liquid asset ratio
The thirty-day liquidity risk indicator (IRL) was chosen, which is defined as:
IRL = ALM/RNL
where *ALM* is the liquid assets adjusted for market liquidity and exchange risk, and *RNL* are the net liquidity requirements over a 30-day horizon.
b. Ratio of liquid assets to total asset
ALM / total asset
c. Ratio from available to total available
asset / total asset
d. Basic funding ratio
(retail deposits + more than one year funding) / total asset
Where *retail deposits* result from the difference between *total and wholesale deposits*; *Total deposits* are represented by deposits in current account, savings deposits, CDTs, bonds, repos and passive interbank, and the *funding greater than one year* corresponds to bonds greater than eighteen months and CDTs greater than one year.
e. Ratio of wholesale
funding / total asset
where *wholesale funding* is the sum of the SI guiding items: Wholesale deposits, bonds, repos and passive interbank; *wholesale deposits* correspond to the difference between total deposits and deposits originating from households (natural persons) they are extracted from a format sent by the EC to the SFC, which are then adjusted by the total deposit balances obtained from the balance sheet.
Bonds are represented by general guarantee bonds and other bonds less than one hundred months old, general guarantee bonds and other bonds equal to or greater than eighteen months, and mortgage bonds.
Repos and interbank were obtained as the monthly average of daily balances.
Los repos e interbancarios se obtuvieron como el promedio mensual de los saldos diarios.
f. Net stable anchoring (NSFR)
NSFR = ASF / RSF
where the *NSFR* is the reason between the *available stable anchoring* (*ASF*) and the *required stable anchoring* (*RSF*) in the terms provided by Basel III[7].
g. Ratio of monetary liabilities to monetary
passive deposits / deposits
Monetary liabilities are made up of: Simultaneous, transfer of securities, repo and interbank transactions, which were obtained as the monthly average of daily balances.

A1.5 Efficiency

a. Financial management
(*administrative and labor expenses + provisions*) / *MFB*
The items that make up this indicator are annualized flows.
b. Mediation management
(*administrative and labor expenses + provisions*) / *average total asset*
Administrative and labor expenses, and *provisions* are annualized flows, and *total assets* is the average of the balances obtained during the last twelve months to the date of the indicator.

A1.6 Credit and market risks

a. Credit Risk
Total Risky Portfolio / Total Gross Portfolio
Where the *total risk portfolio* is the classified portfolio in categories B, C, D and E.
b. Ratio for participatory investments
investments variable income – investments of subordinates / total investments

7 For a better understanding, see "Basel III: Coefficient of Net stable financing", Committee of Banking Supervision of Basel, Bank for International Settlements, October 2014.

03

Stress Test

This section describes the scenario and the results of the stress test on the CIs that *Banco de la República* carries out every six months. This test, known in the international literature as a stress test, seeks to measure the resilience of the CIs in the event of a hypothetical adverse scenario. The results suggest that the aggregate indicators of the system's capital adequacy were not likely to show values lower than the prudential limits in the scenario that was considered.

The stress test is a quantitative analysis that evaluates the resilience of the CIs in the event of an unlikely, hypothetical adverse macroeconomic scenario. The results indicate that the impact of the scenario on the aggregate capital adequacy of the entities would be limited in magnitude.

Considering the vulnerabilities that have been identified throughout this *Report*, this chapter seeks to calculate the impact on the CIs of a hypothetical scenario in which the growth rate of the Colombian economy declines starting in the fourth quarter of 2018 and continuing until the end of 2020. The adverse scenario considered has been intentionally designed to reflect an extreme situation for the Colombian economy given that it incorporates a variety of shocks occurring simultaneously that would not be very. In this respect, the results of the test do not constitute any kind of forecast of future changes in the economy. Rather, the results should be interpreted as a quantitative evaluation of the resilience of the institutions in the event of an extreme scenario based on their current financial conditions and under restrictive assumptions. Likewise, the exercise assumes that the economic authorities respond to the macroeconomic stress but that there is no policy reaction to the deterioration of

the institutions' financial statements nor preventive measures based on the monitoring of their risk management which would presumably have made the impact of the averse scenario smaller.

The usefulness of the test lies in providing an estimate of the potential losses that would be seen if the extreme scenario were to materialize. Furthermore, the test helps shed light on the possible transmission channels by means of which the vulnerabilities identified could affect financial stability.[34]

The results indicate that there would be negative effects on aggregate indicators of total and core capital adequacy although they would remain at levels above the regulatory limits during the period of the exercise. In addition, the loan portfolio and aggregate profitability of the CIs could present significant deterioration which would reflect the impact that the adverse scenario could have on the ability of the institutions to grant loans and carry on their intermediation operation.

3.1 Macroeconomic Scenario and Materializing Risks

The trajectories of the adverse scenario include a slowdown of the economy over the course of the analysis horizon.

The stress test seeks to capture the effects of an adverse macroeconomic context, which would involve a sustained economic downturn between the fourth quarter 2018 and the same quarter in 2020. Under this scenario, the trajectories of the aggregate variables in the Colombian economy are constructed using a general equilibrium model. The scenario assumes a reduction in aggregate demand for the first year of the test that could be associated with restrictions on external financing and along with a depreciation in the exchange rate of the Colombian peso with respect to the US dollar. For the second year, an intensifying downturn in demand is assumed that could be associated with a lower performance in the advanced economies. In addition, it is assumed that the lending rates will rise gradually to levels that correspond to the maximum historical spreads with respect to the policy interest rate.[35] Under these assumptions, the model predicts a lower-than-expected economic growth, a rise in unemployment, and an increase in inflation.[36]

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34 The technical details of the model used in this test which include a description of the performance of the institutions in a hypothetical scenario and the channels through which their financial health could be affected are presented in the series *Borradores de Economía* (Working Papers on Economics) no. 1028: "SYSMO I: A Systemic Stress Model for the Colombian Financial System," *Banco de la República.*

35 The largest historical spreads of the commercial, consumer, housing, and microcredit loan portfolios were 7.6 pp (November 2016), 20.6 pp (February 2003), 13.5 pp (May 2004), and 31.1 pp (August 2016) respectively.

36 This macroeconomic scenario is constructed in such a way as to take into account the effects of feedback between the financial sector and the productive

A hypothetical scenario of a sustained economic slowdown and high interest rates could entail, during the first stage, the materialization of some of the risks (credit, market, and foreign exchange) that CIs face. The endogenous response of the CIs to the scenario could, at a second stage, unleash the materialization of additional risks that would be likely to have a direct impact on the financial statements of each institution (financing, liquidity, interest rate, and contagion risks).

Concerning credit risk, two elements are considered. For one thing, the natural consequence of a macroeconomic deterioration would increase the default rates of economic agents to increase. The hypothetical trajectories of the quality risk indicators of the four types of loan portfolios are presented in Graph 3.1.[37] The shaded area corresponds to the analysis horizon of the test. For another, the test assumes that the adverse scenario would trigger a gradual one-level displacement in the rating of the commercial loan portfolio granted to vulnerable companies: ones that are exposed to exchange rate risk,[38] have restructured or modified loans,[39] and belong to the building sector and businesses related to that.[40,41] In addition, given the idiosyncratic behavior of certain companies in the health sector, the total displacement of these debtors was assumed.[42]

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sector of the Colombian economy. The level of economic growth in the stressed scenario is determined by using a methodology that allows for the construction of a trajectory with a predetermined level of probability. In order for the scenarios in different Reports to be comparable, the average rate of economic growth is fixed at a probability level of 3%. For more detail on this methodology see Box 1 of the Financial Stability Report for the first half of 2018.

37 To establish these hypothetical trajectories, an autoregressive vector (ARV) model was used for the indicator of quality by risk for each one of the types of portfolios.

38 The companies exposed to exchange rate risk are the ones that present a negative exchange rate mismatch (liabilities in foreign currency greater than assets in foreign currency) and are classified as vulnerable based on four indicators: 1) the value of the currency mismatches to total assets, 2) trade balance to operating income, 3) share of foreign capital in the total capital of the company and 4) depreciation of the equity in the event of a 15% depreciation.

39 For more detail on restructured and modified loans, see External Circular 026/2017 of the Office of the Financial Superintendent of Colombia.

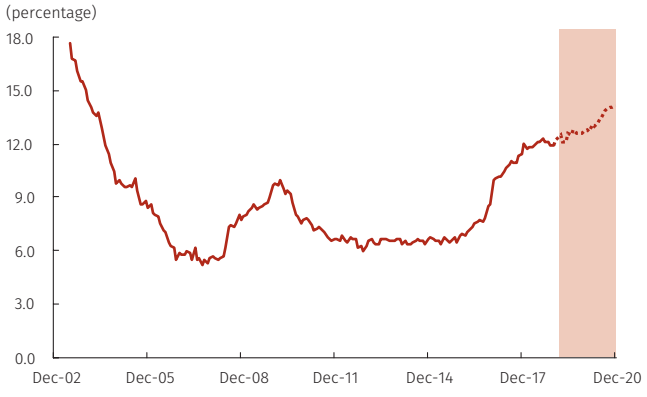
40 Companies that are related to the building sector correspond to companies that do installations, finishing work and final touches, architectural work, and other related operations.

41 As of September 2018, the loans granted to the group of vulnerable companies was 44.7% of the commercial loan portfolio: companies exposed to exchange rate risk represented 13.3%, firms associated with the building sector accounted for 23.7%, and the companies with restructured or modified loans came to 21.3%. Even though this last figure corresponds to the total exposure of the CIs to borrowers who have at least one restructured or modified loan, the restructured or modified loan portfolio comes to only 3.2% of the commercial loan portfolio.

42 The loan portfolio of these companies represented 2.0% of the total commercial loan portfolio as of September 2018. The exercise considers the fact that, on the same date, the CIs have loan-loss provisions for close to 5.5% of the loans granted to these companies.

Graph 3.1
QRI Trajectory by Credit Type

A. Commercial



B. Consumption

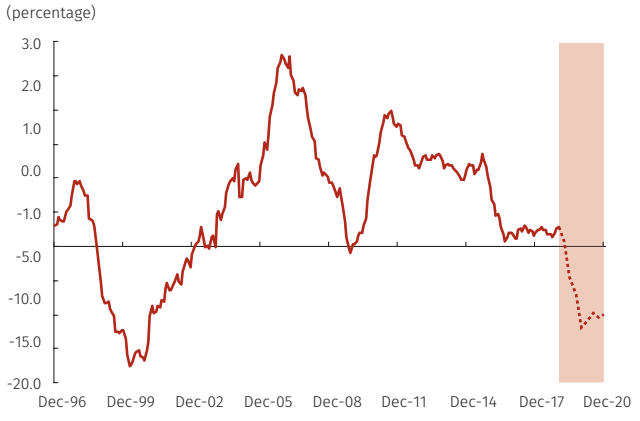
C. Mortgage

D. Microcredit

Source: Office of the Financial Superintendent of Colombia (before December 2018); Calculations by *Banco de la República* (from March 2019 to December 2020).

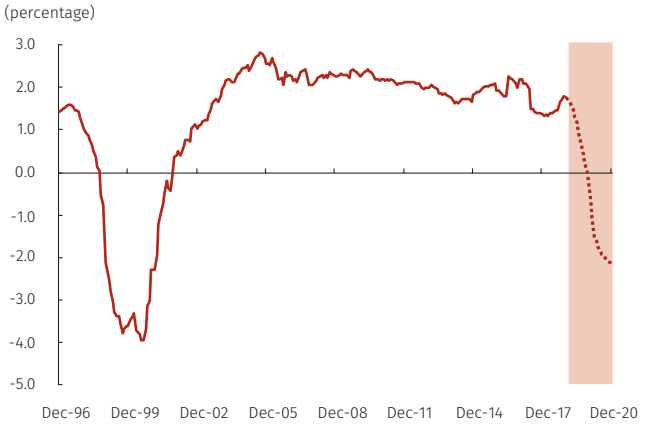
Concerning market risk, two elements are considered. For one thing, the macroeconomic trajectories of the hypothetical scenario generate displacements of the zero-coupon TES curve and the private fixed income curve. In addition, the exercise assumes that the general deterioration of macroeconomic conditions would cause a gradual and permanent exit of foreign bond holders from the local public and private debt market during the first year of the test. As a result, additional displacements are posited coming from the sale of the entire portfolio on the part of foreign investors. Therefore, a widespread depreciation of the curves is generated with a higher magnitude in the longer periods thus causing a spike in them.

Graph 3.2
Loan Portfolio Growth



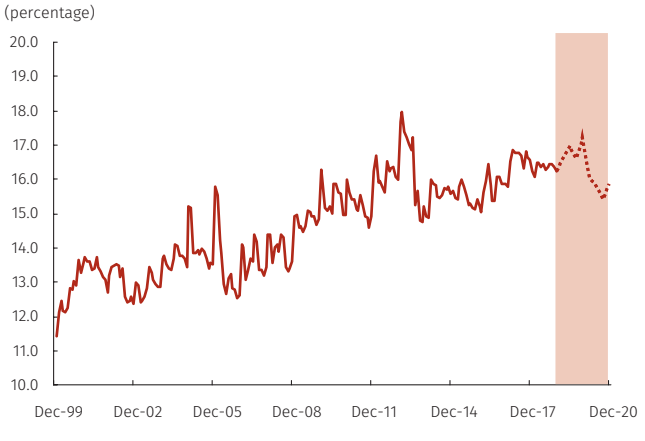
Source: Office of the Financial Superintendent of Colombia (before December 2018); Calculations by *Banco de la República* (from March 2019 to December 2020).

Graph 3.3
Return on Assets (ROA)



Source: Office of the Financial Superintendent of Colombia (before December 2018); Calculations by *Banco de la República* (from March 2019 to December 2020).

Graph 3.4
Capital Adequacy Ratio (TIER II)



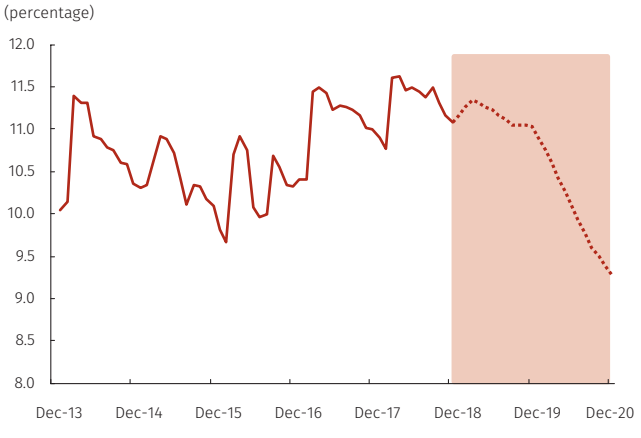
Source: Office of the Financial Superintendent of Colombia (before December 2018); Calculations by *Banco de la República* (from March 2019 to December 2020).

3.2 Results

The trajectories of the aggregate variables of the CIs could develop in the stressed scenario in line with what is shown in Graphs 3.3 to 3.5. The real, annual growth of the loan portfolio would probably remain at levels close to -10.0% (Graph 3.2), and this would be consistent with the greater sluggishness of the aggregate liabilities in the macroeconomic scenario. The lower profits, in turn, generated by the joint manifestation of risks would probably bring about a decrease in the ROA[43] of the CIs. This would fall, going from 1.8% to -2.2% between December 2018 and two years later (Graph 3.3) illustrating the severity of the effects of the stressed scenario on the intermediaries. As a consequence of the lower profits, the ratios of total and core capital adequacy would probably go from 16.2% to 15.9% and from 11.1% to 9.3% respectively while remaining above the corresponding regulatory limits (Graph 3.4 and 3.5).

The ROA that would be seen in the adverse scenario is presented in Graph 3.6, and the components of each one of the risks that are modeled in the stress test are differentiated. Out of the total fall in the profitability indicator during the horizon of the test (4 pp), 57.8% corresponded to the increase in expenditures on loan-loss provisions (credit risk),

Graph 3.5
Core Equity TIER I Ratio



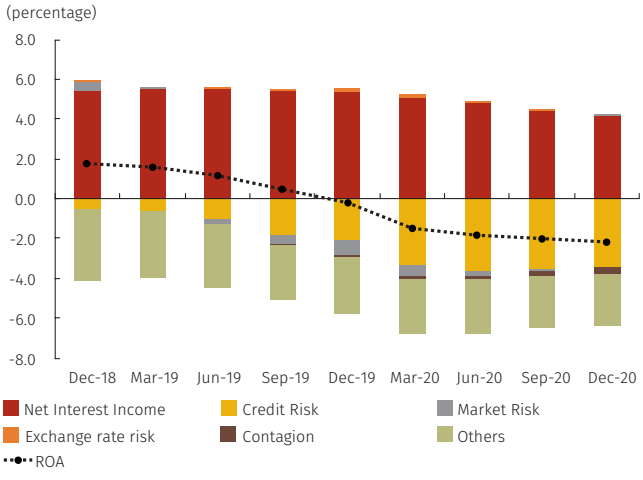
Source: Office of the Financial Superintendent of Colombia (before December 2018); Calculations by *Banco de la República* (from March 2019 to December 2020).

43 The ROA is calculated as the annualized quarterly profit on the asset.

26.0% to the decline in net interest income, 8.4% to market valuation due to market risk, 1.0% to the decline in income as an effect of the exchange rate, and 6.8% to losses due to contagion risk. Regarding what was seen in December 2018, the net income from interest in the adverse scenario would have dropped 24%, the expenditure on loan-loss provisions would have been five times larger, and market risk, which showed a positive contribution, would have fallen 270% at the closing of the first year of the exercise.

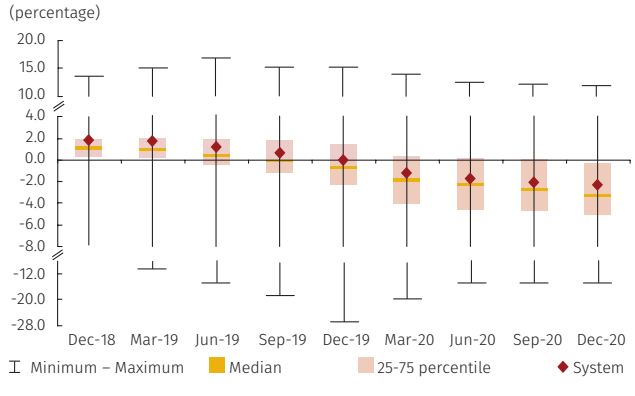
Finally, even though the aggregate indicators of the CIs may have presented levels of deterioration with a moderate impact on the regulatory requirements, the results per institutions are heterogeneous (Graphs 3.7 and 3.8). In terms of the ROA, the institutions with a negative indicator at the end of the test would have gone from representing 1.1% to 72.6% of the total assets in the system. In the case of the individual capital adequacy ratio, the CIs that had shown levels that were lower than the regulatory limit would have accounted for 48.8% of the total assets in the system.

Graph 3.6
Components of the ROA



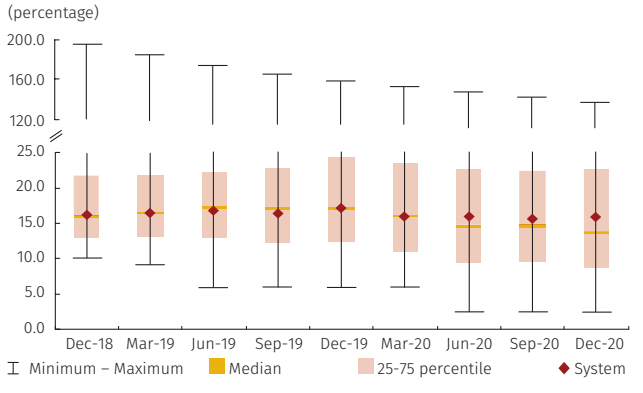
Source: Office of the Financial Superintendent of Colombia (up to December 2018); calculations by *Banco de la República* (March 2019 to December 2020).

Graph 3.7
Distribution of ROA



Source: Office of the Financial Superintendent of Colombia (before December 2018); Calculations by *Banco de la República* (from March 2019 to December 2020).

Graph 3.8
Capital Adequacy Ratio Distribution



Source: Office of the Financial Superintendent of Colombia (before December 2018); Calculations by *Banco de la República* (from March 2019 to December 2020).

3.3 Final Comments

The results of the exercise suggest that the majority of the CIs would be able to keep their aggregate capital and core tier I capital adequacy ratios above the regulatory limits in spite of the severity of the macroeconomic scenario and the resulting reduction in their profitability and ability to grant credit. This reflects the current resilience of the institutions in the event of a macroeconomic scenario like the one described above.

As has been discussed, the stress test presented in this section is built on the basis of a set of assumptions that, by incorporating various shocks

that occur simultaneously, reflects an adverse situation and one that is very unlikely for the Colombian economy. For one thing, it assumes that the economic authorities do not take action in response to the deterioration of the CIs' financial situation. At the same time, the institutions' shareholders are presumed to be excessively passive to the degree that they only capitalize the profits without taking any other kind of strategic initiative in order to face the financial stress.44 If, however, any one of these assumptions is eliminated, the size of the losses to the system would be expected to be cushioned so that the impact of the adverse scenario would presumably be smaller. Last of all, the starting point for the analysis is the individual capital adequacy ratio apart from any consolidated capital adequacy. Therefore, the consolidated results may differ from those presented here.

44 Specifically, the shareholders do not inject outside capital into the business operation, they do not seek synergies or mergers between the institutions, nor manage them in order to increase the efficiency of their operations.

04

Financial Regulation

Decree 1984/October 30, 2018: management and administration of private equity funds

This decree replaces Decree 2555/2010, Part 3, Book 3 in order to bring together the current regulation of private capital funds (PCF) and to incorporate new elements that are consistent with the characteristics of these financial vehicles and their managers. The goals of the decree are: 1) make a clear distinction between the rules for the PCF and for the Collective Investment Funds (CIF); 2) define a specific organizational structure for the PCF and 3) establish a single regulatory body that would define the elements that should certify these financial vehicles and their managers in order to do the work related to the PCF.

The decree holds to the current definition of PCF as a closed CIF that must allocate at least two-thirds of the contributions of its investors to the acquisition of assets other than securities included in the National Registry of Securities and Issuers. In addition, it retains the types of companies that are approved to manage them (SBF, TC and investment management companies) and establishes that the organizational structure of the PCF must be made up of the management company, the professional manager or director, fund investors, the securities custodian, and supervisory bodies.

In addition, the decree: 1) establishes that the shares of PCF can be traded on the secondary market; 2) allows for the conversion of the PCF to real estate CIF through an adjustment in the regulations and without the need to liquidate the first fund; 3) empowers the PCF to finance companies or projects with capital or by means of credit transactions, and 4) authorizes the PCF or its subdivisions to leverage through the issuance of bonds with the prior authorization of the FSC.

Finally, the decree defines the minimum elements to be included in the investment policy, establishes the policies for disclosure of information, defines the prohibitions that will apply exclusively to the PCF and the *conflict of interest* situations, and includes rules relating to carrying out operations with the parent company, the subsidiaries, or companies linked to the managing company or professional manager, if they exist. This decree shall go into effect on the date of its publication.

Decree 2123/November 15, 2018: insurance marketing

Decree 2555/2010 was modified mainly with respect to issues related to the capabilities of the directors or managers of insurance intermediaries and the use of channels for massive marketing of insurance products. With respect to the first point, the eligibility criteria associated with the time of professional experience is removed from the requirements and conditions that are used to assess whether or not the candidate has the capabilities that are required to work in insurance. In relation to the use of the massive marketing channels, the list of insurance products eligible for marketing through this channel was expanded, and the possibility that the FSC would authorize the inclusion of new products was incorporated after checking the requirements defined for this purpose.

The modifications established in this decree go into effect in May 2019

Decree 2413/December 24, 2018: the lease-to-purchase option program

The decree seeks to facilitate the acquisition of housing through the national government program named *Semillero de Propietarios* (*Seedbed of Owners*). In this program, the down payment benefiting families receive a monthly subsidy for the partial payment of rent for a maximum period of two years. In addition, the non-covered percentage of the payment that the families face includes a saving allotment. At the end of the program period, each household will have an amount in savings that will serve as a down payment for the purchase of housing. The program gives priority to people displaced by violence, single mothers, and older adults.

The agents who participate in this proposal are: the families who have applied are going to receive the subsidy and will have an amount saved for the purchase of housing at the end of the period, a trust company that manages the savings and payment of subsidies, and real estate managers that postulate the housing for the program, are responsible for underwriting the rent contracts with or without an option to buy, and are accountable for the suitability of the housing offered. Act 1469/2011 gives the National Housing Fund (FONVIVIENDA) the authority to check the accuracy of the information provided by applicants and to transfer the resources to the trust company through a mercantile trust contract. Finally, the institutions that make investments related to low-income housing projects and that are assigned to the *Semillero de Propiertarios* program can be beneficiaries of FINDETER's rediscount line with a compensated rate. This decree rules since the date of its publication.

SFC External Circular 035 of 26 December 2018: Instructions concerning the calculation of the obligatory minimum return on mandatory pension funds and the portfolios of dismissal funds, the valuation of investments of the special retirement fund scheduled, and the system of eligible expenditure for mandatory pension funds and the portfolios of dismissal funds.

The purpose of the circular is to standardize the methodology for calculating the minimum obligatory return of mandatory pension funds and the long-term portfolio of dismissal funds, among other provisions. In particular: (1) the minimum return measure for the scheduled retirement fund is introduced, (2) the reference portfolio associated with the calculation of minimum return for the accrual-stage mandatory pension funds and for long-term dismissal funds is replaced, and 3) the benchmark for the short-term leave portfolio is modified.

The methodology establishes that the minimum return is calculated as the weighted sum of the profitability of different indices representative of the market. For example, for the moderate fund, the return is calculated for the representative indices of the local fixed income, international fixed income, local equity and international equity markets. To calculate the share of each of these indices, the minimum between the average composition of the moderated portfolio in these categories and the limits established by the investment regime of these funds is used.

The first verification of the minimum profitability of the mandatory pension funds in the accrual stage and of the portfolios of layoffs, under the method introduced in this external circular, was carried out on 30 April 2019. the first verification for the scheduled retirement fund will be done from 30 June 2021.

SFC External Circular 026/November 27, 2018: instructions related to the mechanisms of resolution (bridge bank)

Under the provisions of Decree 521/2018, concerning the regulation of the purchase of assets and the transfer of liabilities and bridge bank, the objective of this norm is to regulate the resolution mechanisms for those CIs ordered to undergo forced administrative liquidation as an alternative to the payment of deposit insurance. The purpose of the above is to enable the transfer of assets and liabilities of one or more CIs in liquidation to one or more bridge banks and/or one or more CIs in order to maintain their value and guarantee the stability of the financial system.

The bridge bank shall be constituted as a mercantile corporation independent from the institution undergoing liquidation and shall hold the status of special credit establishment. Therefore, it will be exempt from complying with minimum requirements of capital, capital adequacy ratio, legal reserve regimes, forced investments, and reserve requirements. The request for the organization of a bridge bank shall be signed by a legal representative of Fogafin and authorized by the SFC.

Once the organization and activation of the bridge bank has been authorized, the legal representative of this institution shall notify the infrastructure providers and the securities custodians about this constitution. In addition, the holders of assets and liabilities must be communicated with regarding the transfer of resources. The bridge bank shall have risk management systems in place during its operation whether by designing its own systems or adopting those of the institution whose assets and liabilities were transferred. These systems shall be subject to SFC oversight given their monitored status under the same terms used to supervise the other CIs.

Decree 2443/December 27, 2018: investment in financial innovation and technology firms

Considering the importance of financial inclusion for the country's economic development, this decree authorizes CIs, financial service companies, and capitalization companies to hold shares in Fintech companies with the exclusive objective of developing and/or applying innovations and technologies in connection to the corporate objective of investing financial institutions. This means that these Fintech companies will not be able to provide financial services.

The decree establishes two prohibitions on the investments that these innovation companies can make: First, they cannot acquire or own stock, stake, ownership interest, or corporate contributions in any kind of company or association. Second, they cannot acquire shares in the CIs, financial service companies or capitalization companies that own shares in their capital, nor in their subordinates. This decree shall go into effect on the date of its publication.

Resolution 02 of February 22, 2019 and External Regulatory Circular DEFI - 360: regulations on the transitory liquidity support from *Banco de la República*

In February 2019, *Banco de la República* (BR) modified the lender-of-last-resort regulations in order to simplify the mechanism for getting access to Transitional Liquidity Support (TLS) and adjust it to the current financial characteristics of the CIs and the market as well as to the regulatory improvements of the FSC.

The main adjustments were: 1) the source of information used in the calculation of the available funds from the TLS was changed; 2) the CIs were authorized to carry out simultaneous TLS operations, transitory expansion operations, intraday repo and its conversion into an overnight repo while clarifying the maximum joint exposure that the CIs may have to these operations; 3) it was established that the CIs must participate in at least one simulacrum of TLS every three years based on the schedule set by *Banco de la República* in coordination with the CIs; 4) the documentation required for access to and maintenance of the TLS resources

was modified; 5) the characteristics of admissibility of the credit securities that the TLS implements were adjusted; 6) the figure of intermediary institution needed to gain access to the TLS was expanded to all CIs; 7) it was determined that *Banco de la República* shall keep the SFC, Fogafin, and Fogacoop informed with respect to access to the TLS, the requests for extension, and the extensions or cancellations made by the CIs; 8) when a credit establishment has collateral capital granted by FOGAFIN or an equity guarantee granted by FOGACOOP, or fails to comply with the rules on individual credit limits and concentration of risks at the individual level, it shall not be able to get access to TLS resources, 9) the TLS amount was adjusted when the CI registered a shortfall in its deposit account with the BR as a direct or indirect consequence of the discontinuance of payments from another establishment during check clearing, 10) in the case of an increase in the TLS amount, and if the CI has financial investment securities committed in financial transactions, such transactions cannot be renewed and as the securities are released, they shall be delivered to the BR, 11) control at the levels of foreign exchange position during the period of the TLS was removed.

Box 6

Foreign Exchange Position and Capital Adequacy Ratio

Tatiana Venegas Karpf*

1- Introduction

Exchange rate risk is a financial risk associated with the fluctuation of the exchange rate of one currency with respect to another and corresponds to the positive or negative difference resulting from the changes in that exchange rate over time. This risk is assumed by those agents who take active or passive positions denominated in a currency other than the one they use for their day-to-day transactions.

The excessive accumulation of foreign exchange risk on the balance sheets of local agents is a matter of concern for *Banco de la República* given that, in a strategy of inflation targeting and exchange rate flexibility, the rate of exchange absorbs external shocks that the economy receives and contributes to a less traumatic adjustment for it. However, the significant currency mismatches that the different agents in the economy have may limit foreign exchange flexibility since a strong shift in the exchange rate may jeopardize the financial stability of the country. This concern is greater in the case of financial intermediaries, because of their importance in the payment system and the provision of credit.

A description of the measures used in Colombia to seek to control the exchange rate risk, the existing disconnect between the capital adequacy ratio and one of *Banco de la República*'s macro prudential measures, and recent changes that were introduced in the measure are outlined in this box.

* The author belongs to the Operations and Markets Development Department of *Banco de la República*. The opinions expressed herein are the sole responsibility of the author and do not compromise *Banco de la República* or its Board of Directors

2. Measurement of Exchange Rate Risk

2.1 Foreign exchange Position and Indicators of Foreign Exchange Risk

As the foreign exchange authority, the Board of Directors of *Banco de la República* (BDBR) sets the macro prudential measures to measure and control the foreign exchange risk of the foreign exchange market intermediaries (FEMI) and of the rediscount public institutions that are not FEMI, in order to limit such exposure, and thereby reduce the likelihood that these institutions may go into bankruptcy in the event of adverse movements in the exchange rate. In particular, the BDBR limits the foreign exchange exposure of these agents by putting limits on the net total foreign exchange position (NTFEP) and on the indicators of exchange rate risk (IERR).

The NTFEP measures the total foreign exchange exposure that the institutions assume at the individual level and its limits are defined as a percentage of the level of the total regulatory capital[1] (TRE) of each intermediary. Currently, the arithmetic average of 3 NTFEP working days has a lower limit of -5% of the TRE and an upper limit of 20% of the TRE (until March 25, 2019 there was a 30% upper limit of the TREfor the FEMI that have controlled investments abroad and are required to consolidate financial statements in accordance with the instructions of the Office of the Financial Superintendent of Colombia -SFC-).

Considering the fact that financial crises typically occur in environments of currency depreciation, the decision has been made to assign asymmetrical controls to the positions that the FEMI and the rediscount public institutions may assume in the foreign exchange market. The lower limit is intended to restrict the taking of short positions in foreign currency in order to reduce the likelihood of institutions going into bankruptcy in the event of scenarios in which the peso is devalued. In contrast, the upper limit seeks to prevent the institutions from taking significant long positions that might lead to them taking substantial losses in the event of an appreciation of the peso. The two limits also prevent the institutions from taking positions that may exacerbate the movements of the exchange rate.

Furthermore, the indicators of foreign exchange risk (IERR: indicator of positive exchange rate risk IERR+, and indicator of negative exchange rate risk IERR-) are designed to control the long and short positions separately in order to show the currency-currency mismatches. These indicators are calculated at the individual or consolidated level depending on whether the institution is or is not required to consolidate financial statements in accordance with the instructions of the SFC.

1 The total regulatory capital is composed of the elements of the equity and liabilities that have the capacity to absorb losses.

For the calculation of the IERR, one NTFEPper currency is estimated using the information from the individual or consolidated financial statements as appropriate, and subsequently, the positions that are positive (long) are added up by currency in the IERR+ and the positions that are negative (short) are added by currency in IERR-. The IERR+ has a limit of +40% of the TE, and the IERR- has a limit of -40% of the TRE (individual or consolidated as appropriate).

2.2 Capital Adequacy Ratio

The Basel Committee on Banking Supervision (BCBS) recommends controlling the exchange rate risk through capital, i.e., using the capital adequacy ratio, which is defined as the ratio of the TREto the risk-weighted assets. The idea behind this indicator is to try to reduce the principal-agent problem that exists when the banks invest public resources. Thus, an effort is made to ensure that banks have a minimum level of invested capital subject to the risks to which their business is exposed, and that this capital can be used as a basis for absorbing the institution's potential losses. In Colombia, the capital adequacy ratio is intended to ensure that the TRE of each institution is at least 9% of the assets adjusted for the risks to which it is exposed and is defined as:

$$RS = \frac{TRE}{RWA + \frac{100}{9} MR}$$

Where TRE represents the technical equity, RWA corresponds to the risk weighted assets to which they are exposed, and MR represents the market risk, defined as the maximum loss that the institutions may experience in their positions in the event of adverse movements of a price or rate in the market. This value is multiplied by a factor of 100/9 so that the potential unexpected loss from this risk will be fully backed by capital.

The exchange rate risk to which institutions are exposed is included in the calculation of market risk. This risk incorporates both the *trading positions* from the treasury book[2] and the positions included in the banking book[3] and uses some sensitivity factors to calculate the unexpected loss caused by fluctuations in the exchange rate. Although the BCBS suggests some sensitivity factors calculated for a horizon of 10 days, the sensitivity factors currently used in Colombia are based on an estimate for a horizon of 30 days and correspond to 12.49% for the dollar, 11% for the euro, and 13.02% for other currencies.

2.3 Trade-off between the NTFEP and the Capital Adequacy Ratio

Although the NTFEP and the capital adequacy ratio are intended to stop the institutions from taking excessive risks on their balance sheets, the way they are defined can generate contradictory incentives with respect to foreign exchange risk. Thus, while the NTFEP and IERR encourage foreign exchange coverage through liabilities, which in the event of a shock to the exchange rate protects the level of equity, capital adequacy encourages the coverage of risks with capital so that institutions have sufficient capital to hedge their exposure to various risks.4

In view of the above, if there is a risk of the peso appreciating, it would be favorable in the case of institutions with long positions in foreign currency to have their foreign exchange risk completely covered (since equity is not affected and, to that extent, the capital adequacy increases). In the event of a risk of depreciation that incentive may not occur due to the fact that the capital adequacy ratio would benefit or be less affected (if it decreases in the case of depreciation) if the foreign exchange position is uncovered.

To illustrate this point, a simple example is presented in which the following is assumed: the equity is equal to the TRE,5 the gains and/or losses due to changes in the exchange rate always affect the institution's TRE (the latter is still not applicable for the institutions at the individual level, but it is, in the case of the calculations at the consolidated level6), the factor of sensitivity to exchange rate risk is 8% and foreign exchange risk is calculated on the difference between assets and liabilities denominated in foreign currency (there are no other market risks).

2 The treasury book consists of the set of positions that are a product of the treasury operations that the entity maintains in order to benefit in the short-term from price fluctuations as well as those investments that are sensitive to fluctuations in market variables. Along this line, the treasury book covers, along with others, the total negotiable investments and investments available for sale (Basic Accounting and Financial Circular, Chapter 21, number 1.7).

3 The banking book consists of the set of positions from: (i) the institutions' income operations from the current and savings accounts, term deposits, the issuance of bonds, etc.; (ii) the loan portfolio; (iii) the establishment of guarantees and collateral, (iv) investments until maturity, and, in general, (v) any transaction that is not included in the treasury book (Basic Accounting and Financial Circular, chapter 21, number 1.6).

4 In addition, this measure seeks to align the incentives in the risk-taking by the shareholders of the institutions and their customers, by requiring a minimum level of capital to carry out various active operations.

5 The technical equity consists of instruments that have the capacity to absorb losses. Therefore, not all equity items are included in the TRE (for example: trade credit).

6 Currently, the measurement of the TRE does not include the effect of fluctuations due to changes in the exchange rate that go directly to the ORI (other comprehensive income). This generates an asymmetry between the TRE and the denominator of the capital adequacy ratio in the event of shocks to the exchange rate. This asymmetry will be resolved in February 2020 when the ORI becomes part of the TE.

There are two institutions with the following balance sheet:

Institution A	
Assets	**Liabilities**
COP 500	COP 500
USD 100	
	Equity
	COP 100
PP/Equity = 100%	
Initial CAR = 14.52%	

Institution B	
Assets	**Liabilities**
COP 500	COP 400
USD 100	USD 100
	Equity
	COP 100
PP/Equity = 0%	
Initial CAR = 16.67%	

Note: All values on the balance sheet are expressed in pesos. COP and USD indicate whether this amount is from an asset or liability denominated in pesos (COP) or in US dollars (USD).

Institution A has a fully uncovered long position in foreign currency due to which it has a 100% PP. In addition, it registers a capital adequacy ratio of 14.52%. Moreover, institution B has a balance similar to that of institution A, but with the difference that its position in foreign currency is fully hedged (PP equals 0%). When this institution is not exposed to exchange rate risk, it registers a higher capital adequacy (16.67%) given that its MR is zero. Assuming that there is a 50% depreciation of the COP/USD exchange rate, the following changes in the balance and capital adequacy of the institutions would be seen:

Institution A	
Assets	**Liabilities**
COP 500	COP 500
USD 150	
	Equity
	COP 150
PP/Equity = 100%	
Initial CAR = 19.15%	

Institution B	
Assets	**Liabilities**
COP 500	COP 400
USD 150	USD 150
	Equity
	COP 100
PP/Equity = 0%	
Initial CAR = 15.38%	

Note: All values on the balance sheet are expressed in pesos. COP and USD indicate whether this amount is from an asset or liability denominated in pesos (COP) or in US dollars (USD).

In the event of depreciation, the value in pesos of institution A's assets in foreign currency will rise by the same magnitude as its equity does. This could generate an increase in the capital adequacy ratio. In the case of Institution B, the assets and liabilities in foreign currency, in turn, would probably rise by the same value. This would lead to its equity remaining constant and, consequently, the capital adequacy of institution B would decline due to the increase in the denominator.

As can be seen, the institution that has their foreign exchange exposure hedged will see its capital adequacy negatively affected as a result of the depreciation of the currency while the institution that is assuming the foreign exchange risk registers an increase in their capital adequacy. This occurs because the hedging nullifies the effect of the depreciation of the peso on the equity (perfect coverage) whereas when there is no hedging or it is partial, depreciation of the currency leads to an increase in the equity and partially compensates for the rise in the denominator.[7]

If institution A would like to keep its capital adequacy constant at a ratio of 14.52% in the event of a peso depreciation of 50%, they would have to have liabilities at a value of 42 pesos denominated in USD, which would be equivalent to 27.8% coverage.

The above implies that in scenarios of peso depreciation, greater exchange rate risk hedging using liabilities could have negative effects on the capital adequacy ratio, or seen another way, the upper limit of the NTFEP could be restrictive for institutions that decide to have an uncovered long position to reduce the negative effect. This problem also occurs in economies with high degrees of dollarization[8].

2.4 Adjustment to the Capital Adequacy Ratio

Since Basel II, the BCBS has acknowledged that the institutions may wish to maintain their position in foreign currency without full hedging in order to decrease the effect on the capital adequacy ratio in the event of the shifts in the exchange rate. That is why it stipulated that the institutions that have a structural position in uncovered foreign currency for this reason may exclude the position from market risk with the approval of the supervisor.[9]

The problem with this approach is that the BCBS is ignoring the market risk that these positions have. This risk may be significant in emerging countries and, even more so, if the fact that structural investments are long-term is considered. During the period of flotation in Colombia, the peso has experienced an appreciation (investment risk that the BCBS allows to be excluded from the exchange rate risk in capital adequacy) of up to 44.3%.

Another approach, which the BCBS does not consider and that would definitely solve the problem of the capital adequacy ratio caused by the movements of the exchange rate, is that the assets weighed by the level of credit risk may not change as a result of movements in the exchange rate if they have total foreign exchange hedging.[10]

7 When the exchange rate coverage is partial, the institution's capital adequacy could decrease.

8 "The Exchange Rate Risk that Financial Institutions in Dollarized Economies Have." Superintendency of Financial Intermediation Institutions in Uruguay.

9 International Convergence of Capital Measurement and Capital Standards. 718 (xxxvii xxxviii).

10 Or change proportionally if they have partial hedging.

In Uruguay, a country with a high degree of dollarization, the decision was made to adjust the capital requirement for foreign exchange risk11 such that net foreign exchange exposure per currency would be determined as the difference between assets and liabilities in each currency12 while deducting the "structural position by currency", which is equivalent to the accounting equity multiplied by the proportion of assets in each currency13 and divided by the total assets.14 This helps to preserve the capital adequacy ratio without departing from what is established by the BCBS.

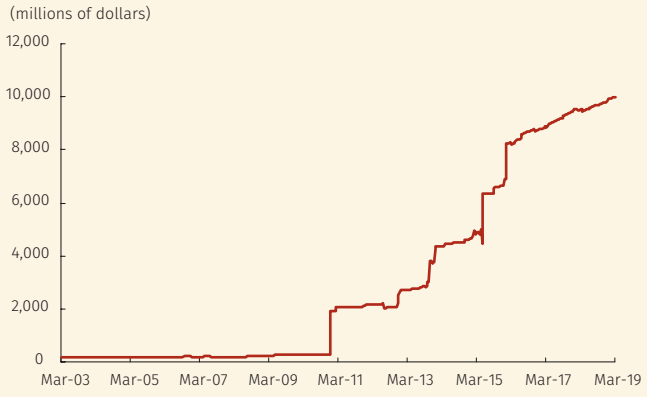
3. Exchange Rate Risk of Controlled Investments Abroad

The expansion of Colombian banking abroad has involved a change in the balance sheet structure of some intermediaries that has been reflected in a higher value of the investments denominated in foreign currency. In particular, as can be seen in Graph B7.1, the value of investments in subsidiaries, affiliates, and joint ventures, and the contributions in branch offices in foreign currency15 presents an increase from 2011 and, in March 2019, stood close to USD$10.000 billion for the FEMI total which, as a share of the total TE, is close to 35%.

The increase seen in the value of these investments reflects the acquisition of institutions abroad on the part of the FEMI and is affected by the adoption of International Financial Reporting Standards (IFRS), which required that the value of retained earnings abroad and all the trade credit generated by these acquisitions be included within the assets denominated in foreign currency.16

The increase in these investments in foreign currency within the balance sheets of some FEMI, has made the disconnect between capital adequacy and macro prudential measures that seek to limit the foreign exchange risk more evident since, as was explained, it may be desirable for some FEMI with growing foreign currency assets to be uncovered with respect to the exchange rate to protect their capital adequacy ratio in the event of adverse movements in the exchange rate.

Graph B6.1
Investments and Contributions in Subsidiaries and Branches



Source: Office of the Financial Superintendent of Colombia.

When this disconnect for the FEMI is analyzed, the conclusion was drawn that the exchange rate risk should be monitored regardless of the position that gives rise to the risk. However, considering the fact that the investments in subsidiaries and affiliates are not current, it was felt that it would be appropriate to modify the macro prudential measures of the FEMI in order to separate control of exchange rate risk from controlled investments and the exchange rate risk from other positions on the balance sheet. Thus, the BDBR made the following decisions on March 22, 2019:

- To exclude the FEMI that have controlled investments abroad and are required to consolidate financial statements in accordance with instructions from the FSC, the value of these investments and the value of the derivatives as well as other obligations designated by the FEMI governing body as hedging instruments for these investments in compliance with the IFRS hedge accounting requirements from the calculation of the PP. This way, the NTFEP restricts the foreign exchange risk of the foreign currency positions other than capital investments as was envisaged at its origin in the 1990s.
- To create the Position of Controlled Investments Abroad (PCIA) to measure and monitor exchange rate risk of the FEMI controlled investments abroad.

Adopting the solution referred to in section 2.4 was not considered as it departs from what has been defined by the BCBS for the calculation of the capital adequacy ratio.

4. Position of Controlled Investments Abroad (PCIA)

As the macro prudential measurement of the FEMI, the PCIA makes it possible to monitor the foreign exchange rate risk of the controlled investments abroad and helps to reduce the disconnect between the NTFEP and the capital adequacy ratio since these investments can be used to immunize capital adequacy without being affected by the upper limit of the PP.

11 Document entitled "The Exchange Rate Risk that Financial Institutions in Dollarized Economies Have." Superintendency of Financial Intermediation Institutions in Uruguay.

12 Including the net delta position equivalent in options on that currency.

13 Including the net delta position equivalent in options on that currency.

14 $A_i - P_i - K \frac{A_i}{\sum_{i=1}^{n} A_i}$, where i corresponds to each currency.

15 This value corresponds to what was reported on format 230 (Report of its proprietary position) and includes, in addition to the investments, the contributions in foreign branches.

16 The FEMI which had included the trade credit in legal currency in their accounting prior to the adoption of IFRS, had to include it in the assets denominated in foreign currency.

The PCIA is calculated as the difference between the value of the controlled investments abroad, and the value of the derivatives and other obligations designated by the governing body of the FEMI as hedging instruments of said investments in compliance with the IFRS hedge accounting requirements:

$$\textbf{\textit{PCIA}} = \textit{controlled investments abroad - liabilities designated as hedging for such investments.}$$

The PCIA cannot exceed the equivalent in foreign currency to one hundred and fifty percent (150%) of the technical capital for controlled investments, which are defined as:

$$PT_{IC} = PT - \frac{11{,}5}{100}\left(APNR^{o} + C_{IC} + \frac{100}{9}\,VeR\,RM^{o} + \frac{100}{9}\,VeR\,RO\right)$$

The PT_{IC} purports to measure the remaining technical equity once the rest of the risks that the intermediary is exposed to (credit, market and operational) are discounted under the consideration that for every 100 pesos of exposure, the institution must have 11.5 pesos in capital and a factor of sensitivity to exchange rate risk for unhedged, controlled investments (44.3%).

5. Conclusions

The excessive accumulation of foreign exchange risk on the balance sheets of local agents is a matter of concern for BR and, to that extent, there are a series of macro prudential measures which seek to limit exposure to that risk that are applicable to the FEMI and some that are applicable to the rediscount public institutions that are not FEMI.

The BCBS recommends controlling the exchange rate risk of financial institutions through capital, i.e., through the capital adequacy ratio. However, for institutions with long positions in foreign currency, it may be more expedient to assume currency risk (uncovered positions in foreign currency) because that would allow them to protect the capital adequacy ratio from changes in the foreign exchange rate.

The expansion of Colombian banking abroad has involved a change in the balance sheet structure of some intermediaries that has been reflected in a higher value of the investments denominated in foreign currency. This has made the disconnect between capital adequacy and macro prudential measures laid down by the BDBR to limit the foreign exchange risk for the FEMI more evident.

When the disconnect between capital adequacy and the macro prudential measures was analyzed for Colombia, it was considered expedient to modify one of the FEMI macro prudential measures in order to separate the monitoring of the foreign exchange rate risk for controlled investments from the exchange rate risk for the other positions on the balance sheet.

Thus, the Board of Directors decided on March 22, 2019: 1) to exclude (the FEMI that have controlled investments abroad and are required to consolidate financial statements in accordance with instructions from the FSC), the value of the controlled investments and the value of the derivatives as well as other obligations designated by the FEMI governing body as hedging instruments for these investments in compliance with the IFRS hedge accounting requirements from the calculation of the PP. 2) to create the PCIA to measure and monitor the exchange rate risk for the FEMI's controlled investments.

Box 7
Considerations Regarding the Memory of Credit Bureaus

Daniel Osorio*

One of the basic problems that credit markets face is the one that literature refers to as the problem of "asymmetric information" (Akerlof, 1970). This arises from the inherent difficulty of distinguishing debtors with good creditworthiness from those without creditworthiness. The latter represent a high risk of losses for credit institutions and their depositors. To deal with this problem, some credit institutions might establish hard lending standards for granting a loan (for example, high interest rates) that would discourage debtors with good creditworthiness. Thus, asymmetric information has negative effects on access to credit and financial inclusion and, to the extent that it discourages debtors who have the ability to pay, it also has negative effects on the stability of the financial system.

That is why public policy has sought to establish mechanisms that would mitigate the problem of asymmetric information in order to strengthen access to credit and promote financial stability. One of these mechanisms is the existence of credit bureaus (CB). As Jappelli and Pagano (2002) and Brown et al. (2008) have shown, CBs that provide accurate, reliable, and timely information have positive effects on the quantity and quality of credit in the financial system. This is especially pertinent to the case of debtors who do not have assets that could serve as collateral for a loan (e.g., debtors with low-wealth or low-income), in which case, their access to credit is crucially dependent on the information that exists about them.

Of course, a critical policy goal in this regard is the proper regulation of the CBs as well as activities associated with sources, users, and holders of information. An important element of regulation is the length of time negative reports are held under the understanding that it is important to recognize that negative reports should be eliminated to the degree that they become less informative about the current creditworthiness of the owner of the information. At the same time, it is essential for the negative reports to stay in the CBs long enough so that they may be informative for the information users whenever a debtor's creditworthiness needs to be assessed. Thus, efforts are made to ensure that the information that the CBs have is as accurate and reliable as possible and, as a result, the problem of asymmetric information is mitigated and greater access to credit, financial inclusion, and financial stability is ensured.

The literature has some empirical studies that evaluate the impact of reducing the time that negative reports remain on the books (something that is referred to in the literature as the CB memory). These studies conclude that reducing the memory has a negative impact on access to and quality of credit. In the case of Sweden, Bos and Nakamura (2011) found that the reduction of the memory carried out in 2003 (up to a maximum of three years) improved access to credit for borrowers with negative reports but increased the probability of default. This suggests that the reduction of memory destroyed negative reports that were still informative which, as a result, increased defaults and affected the stability of the financial system. In the case of Bolivia, Ioannidou and Ongena (2010) found that a short credit history (two months, in the Bolivian case) has an adverse effect on financial inclusion to the degree that it exacerbates the problem of asymmetric information for those banks that receive applications from potential debtors about whom they have no information. Musto (2004) found that in the case of the United States, the elimination of negative reports is "efficiency in reverse," in the sense that, even though some debtors get more credit in the short term (since the elimination of negative reports artificially creates a better credit history), in the long term, this effect disappears and the only remaining consequence is a higher rate of defaulting on loans with the resulting negative effect on financial stability.

In the case of Colombia, Bos, Morales, and Roszbach (2017) found that the reduction in the CBs' memory caused by the transitional regime of Act 1266/2008 had the effect of reducing the size of disbursements by banks and increasing their margins. This is consistent with the consequences of asymmetric information mentioned above. At the same time, one of the effects of the Act's transitional regime was the increase in the periods of non-payment. With respect to the same transitional regime, Gonzalez and Osorio (2015) found that the reduction in the size of disbursements mainly affected debtors with an impeccable credit history. The above suggests that while the reduction in memory might benefit those debtors with negative reports, this would be achieved at the expense of borrowers with good behavior and clean credit histories. Public policy should strive to encourage and not jeopardize those debtors with this responsible and healthy behavior.

* The opinions expressed here are the sole responsibility of the author and do not imply any commitment on the part of *Banco de la República* or its Board of Directors.

These findings also have an important implication in terms of the culture of non-payment. In the public discussion, the tendency is to think that the reduction of the CBs' memory would have the effect of generating a culture of timely payments among debtors, who would have an incentive to pay their debts in view of the more limited time that the negative reports would remain on the books. However, what the literature suggests is that the effect of reductions of the memory is precisely the opposite, that is, it generates a culture of non-payment, to the extent that when the CBs' memory is reduced, those debtors who fail to pay their debts are rewarded while at the same time, those debtors who, in spite of all their difficulties, maintain a spotless credit history are harmed. The above would have a significant negative effect on financial stability: for example, as was mentioned earlier, according to Bos et al. (2017), when CBs' memory was reduced due to the Colombian transitional arrangements for Act 1266/2008, this had the unintended consequence of increasing default length. This reflected the increase in the culture of non-payment and certainly had a negative effect on financial stability.

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