FINANCIAL STABILITY REPORT

March 2017

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Executive Summary

The analysis of credit institutions between August 2016 and February 2017 showed a lower real growth of the loan portfolio, mainly explained by commercial loan-portfolio dynamics. The quality and non-performing loan indexes featured increases for all loan portfolio modalities; however, these levels remained below those observed in 2009, in general. As for liabilities, they continued with the declining trend shown since the second half of 2016. By composition, term deposit certificates at longer maturities and savings accounts increased their share.

Regarding non-banking financial institutions, a slowdown was registered in assets in February 2016, both in proprietary and third-party positions, compared to that observed in August 2016. Regarding proprietary and third-party loan portfolio compositions, investments mainly concentrated in domestic issuers' government and private debt securities. In addition, increases in the return on assets index (ROA) for all types of entities were observed in the same period.

Analysis of the main debtors of the financial system shows that the corporate sector featured a decrease in debt as GDP percentage during 2016. As for the private sector, this reduction took place since debt with domestic financial institutions grew at a lower rate than the output, and that funding with overseas suppliers was reduced due to exchange-rate appreciation. Regarding the public sector, the decrease was given by lower financing in foreign currency with domestic financial institutions, and by a reduction, due to appreciation of the Colombian peso, of bonds issued abroad, and debt with bilateral entities.

Household debt increased between August 2016 and February 2017, mainly in the consumer modality. This dynamics was accompanied by a relative stability in the financial burden indicator calculated at the aggregate level. On the other hand, non-performing loans and quality indexes showed increases during this period, with a highlighted deterioration of personal loans.

As for market risk, the main exposure by financial institutions was concentrated in the fixed-income market. These securities exhibited valuations during the latter half of 2016 and the first months of 2017, driven by a greater global appetite for risk and by monetary policy stance changes.

Variable yield market had a stable behavior due to oil price low volatility during the second half of 2016.

The liquidity risk indicator shows that credit institutions had adequate levels of liquid resources to meet their short-term obligations. On the other hand, credit institutions' liabilities and equity dynamics continued with the decreasing trend featured since mid-2015, highlighting the negative contributions of demand deposits, money market lending operations, and bank credits and financial obligations. Also, it is noteworthy that term deposits were the item that most positively contributed to funding real annual growth.

Finally, the proposed sensitivity tests assessed the resilience of credit institutions to a negative (and unlikely) scenario, with an investment shock, a global confidence decline in the Colombian economy, and the materialization of a set of risks for the system (credit risk, market risk, and funding risk). Results indicate that the impact of the hypothetical scenario on the total solvency of credit institutions would have a moderate magnitude. At the same time, certain negative effects on the volume of the loan portfolio, its quality, and the profitability of the intermediation business would be observed. This shows the importance of continuing with the careful monitoring of the financial situation of debtors and entities.

Juan Jose Echavarría
Governor

FINANCIAL STABILITY REPORT

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Under the mandate given by the Constitution of Colombia, and according to regulations by Act 31 of 1992, *Banco de la República* (the Central Bank of Colombia) is responsible for ensuring price stability. Proper completion of this task crucially depends on maintaining the financial stability.

Financial stability is understood as a situation in which the financial system efficiently intermediates financial flows, contributing to a better allocation of resources and, hence, to the maintenance of macroeconomic stability. Therefore, financial instability directly affects macroeconomic stability and *Banco de la República*'s capacity to fulfill its constitutional mandate, which highlights th e need to promote the monitoring and maintenance of the financial stability.

The tasks that *Banco de la República* carries out in order to promote financial stability are the following: first, the Bank is responsible for ensuring the proper functioning of the Colombian economy payment system; second, it provides liquidity to the financial system through its monetary operations and making use of its constitutional feature of lender of last resort; third, the Bank contributes, together with the Office of the Financial Superintendent of Colombia, and within its credit authority functions, in the design of financial regulatory mechanisms to reduce the incidence of episodes of instability; and finally, *Banco de la República* exercises a careful monitoring on the economic trends that may threaten financial stability.

The Financial Stability Report is in the framework of this last task, serving two purposes: first, to describe the recent performance of the financial system and its main debtors, in order to visualize future trends around this behavior and, second, to identify the major risks faced by credit institutions. With these goals, it is purported to inform the general public about the trends and risks related to the financial system as a whole.

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I. MACROECONOMIC ENVIRONMENT

The U.S. recorded an acceleration in the second semester of the year, in spite of the appreciation of the US dollar, …

Growth of major developed economies showed improvement in the second half of 2016. In the case of the United States, a 3.5% growth was registered in the third quarter (the highest recorded since 2014), and a 2.1% one in the last quarter of the year (Graph 1). These expansions were higher than those in the first half of the year, a result of personal consumption expenses and private investment good performance, with 2.4% and 1.5% growths in December respectively. The component that prevented a greater acceleration was net exports, which recorded a 1.8% annual contraction.

The poor performance of the United States trade balance was framed in a context of strengthening of the US dollar, which affected its exports profitability (Graph 2). This appreciation accelerated given the good results that the U.S. economy has registered in the labor market, as well as by an inflation rate that is already reaching the Federal Reserve goal. This has led to an increase in the market expected monetary policy rate, which reaches a 1.0% projected level by August 2017 (Graph 3).

Graph 1
United States Real GDP Growth

(Percentage)
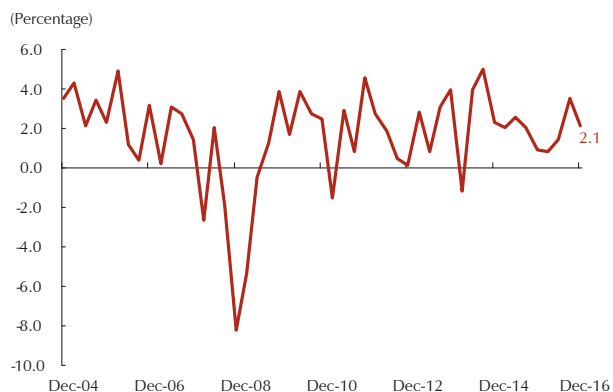
Source: Bureau of Economic Analysis.

Graph 2
Dollar Index Spot

Source: Bloomberg.

…while the euro zone recorded a better growth in the second half of 2016, as well as advances in inflation expectations, which led to a reduction in the European Central Bank asset purchase program.

(Percentage)

Note: Rates expectations are derived from federal funds futures and options contracts.
Source: Bloomberg.

On the other hand, the euro zone kept its expansion pace in 2016, reaching a 1.8% annual real growth in the last quarter. This was the result of real activity and confidence indicators improvements, which increased industrial production and consumption of the countries in the region. Exports also reported growth, reaching 1.5% in the fourth quarter of 2016 (the best record in the last two years). The impact of Brexit was lower than expected, so major agencies have increased their euro zone growth forecast, although some uncertainty still persists given the slow implementation of the separation[1]. As for inflation, slight advances have been noticed, although it remains far from the long-term goal. Notwithstanding the foregoing, expectations increased, which led the European Central Bank to reduce its asset purchases program from 80 to 60 billion euros starting in March 2017.

China continues with its fiscal stimulus program, preventing a more pronounced slowdown.

China registered a 6.7% annual growth in the last quarter of 2016, bringing the total growth of the year to 6.7%, a figure lower than the 6.9% reported in 2015. Despite the fact that consumption maintained its expansion pace, a lower investment in capital generated the observed slowdown. This adjustment is consistent with the Chinese government's plan to generate a mid-term growth based on domestic consumption, thus generating a lesser dependence on external demand. The stimulus program, which has mixed expansionary fiscal policy with flexibility in the credit granting, generates risks in long-term growth given the slow progress in loan portfolio quality indicators offset, particularly the one destined to the private corporate sector.

Latin American economies, in aggregate, suffered a slowdown in the second half of 2016. Argentina, Ecuador, and Brazil reported decreases, while Mexico and Chile recorded lower growth rates. Peru, on the other hand, had a significant expansion thanks to its mining production.

On the other hand, Latin American economies economic performance deteriorated in the second half of 2016 (Graph 4). Argentina and Ecuador

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1   For more information, see *World Economic Outlook (WEO) Update*: A Shifting Global Economic Landscape (January 2017).

reported decreases in the third quarter (-3.8% and -1.6%, in that order), given investment reductions. In addition, Argentina registered a decline in consumer spending, and Ecuador a lower public spending. Brazil also reported a real decrease in the fourth quarter of 2016 (-2.5%), although it has been the smallest contraction in the last seven quarters. The drop in household consumption (-2.9%) and the lowest investment in fixed capital (-5.4%), were the main determinants of the contraction of the output.

Annual real economic growth for some Latin American countries

(Percentage)
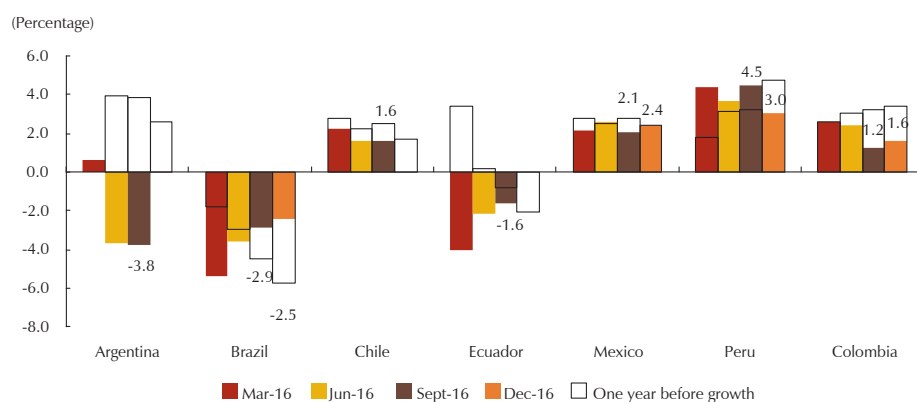
Note: corresponds to the official annual growth for each country.
Source: Bloomberg

Chile continued its slowdown path, by registering a 1.6% expansion in September of 2016, less than 2.5% from a year ago. Weakness of its mining sector and in some industrial sectors negatively impacted its growth. Mexico also showed a slight deceleration, reaching a 2.4% expansion in the fourth quarter, lower than the 2.5% in the first quarter of 2015. Weakness of investment in its non-residential construction sector is its lower growth main determinant. On the other hand, Peru showed the best performance in the region, registering accelerations in the first three quarters of the year, representing a 3.9% growth for 2016. This good performance is attributed to copper exploitation in Las *Bambas* and *Cerro Verde* mines, which led the growth of the mining sector to 14.7% in the third quarter. However, manufacturing production has suffered contractions in recent quarters.

Prices of commodities increased in the last six months. Demand increases, as well as reductions in global supply excesses, led to growth in the international prices of metals and hydrocarbons.

As for the commodities price behavior, in the last six months a growth trend was observed, mainly in metals and hydrocarbons sectors. For the first, a 17.5% expansion between September 2016 and March 2017 was observed, comportment explained by a better demand outlook for this year, accompanied by a global offer reduction. On the hydrocarbons, the international price

Graph 5
Graph 5 Commodities price indexes

(March 2015 index = 100)
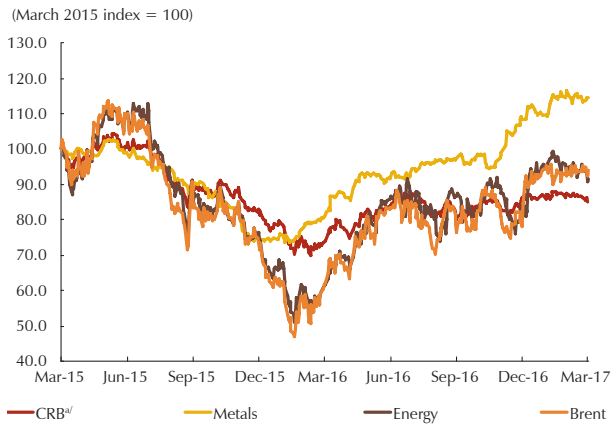
a/ CRB index: Commodities futures price index of the Commodity Research Bureau.
Source: Bloomberg.

of oil had increases in Brent (23.0%) and WTI (23.6%) references in the same period (Graph 5). The production reduction agreement reached by OPEC members, along with other producing countries, generated a global oversupply decrease, which generated an increase in the international price of crude oil.

Colombia reached its lowest annual growth rate since 2009. The contraction of the mining and quarrying sector, as well as the slowdown in agricultural; electricity, water and gas, and trade sectors, significantly impacted the output in the year 2016. The expected growth for 2017 was adjusted downwards.

For the case of Colombia, a 1.6% annual real growth was recorded by the fourth quarter of 2016, lower than the 3.4% obtained in the previous year. Full growth of the year 2016 reached 2.0%, the lowest since 2009 (Table 1). When assessing sector performance, it is evident that mining and transport, storage and communications industries were the ones with the lower expansion, with contractions of 6.5% and 0.1%, respectively. Likewise, significant downturns in agriculture; electricity, gas and water; trade, repairs, restaurants and hotels, and in social, community and personal services, were observed. Industries with the best performance were financial, real estate and businesses services, and construction, with expansions of 5.0% and 4.1% respectively.

Table 1
GDP annual real growth by economic activity industry (unseasoned series)

	2015	2016
Agriculture, forestry, hunting and fishing	2.5	0.5
Mining, Manufacturing	0.2	(6.5)
Electricity, gas and water suppliers	1.7	3.0
Construction	3.0	0.1
Wholesale and retail, repair, restaurants and hotels	3.7	4.1
Transport, warehousing and communications	4.6	1.8
Financial, real estate and companies services	2.6	(0.1)
Social, communal and personal services GDP	5.1	5.0
Servicios sociales, comunales y personales	3.1	2.2
PIB	3.1	2.0

Source: DANE.

The slowdown that the Colombian economy has experienced is framed in a context of adjustment to lower trade terms and a lower level of disposable domestic income. In addition to the above, the local economy has had to face with the supply shock associated with the truck drivers' strike in the analyzed period. The previous behavior implied that growth expectations of the Bank's technical staff for 2017 have been revised downwards, being 1.8% the most likely growth for this year[2].

On the demand side, deterioration in investment and household consumption components has been observed, in a context of low consumer confidence.

Graph 6
Gross capital formation annual growth

(Percentage)
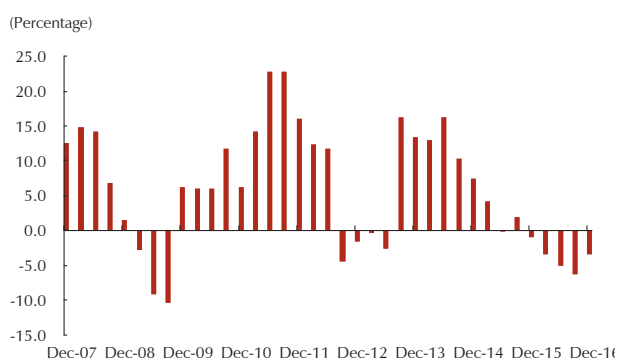
Source: DANE.

Graph 7
Consumer confidence index

(Percentage)
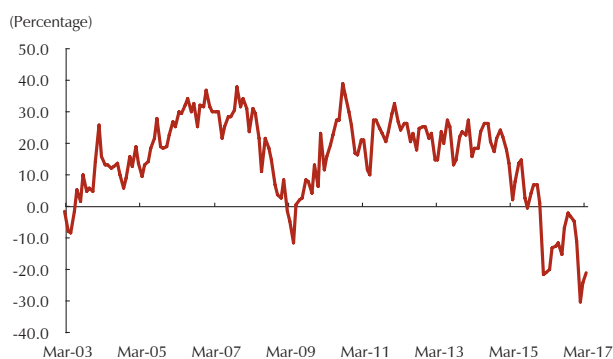
Source: Fedesarrollo.

Demand has shown annual contractions in the gross capital formation component in the last five quarters (Graph 6). For 2016, these investments had a 4.5 % real decline, mainly explained by the decrease in purchases of machinery and equipment (-15,1%) and transport equipment (-11,9%). The civil works component, which has the highest share in fixed capital investment (33.6%), had a significant slowdown, going from a 5.3% growth in 2015, to 2.4% in 2016.

Household consumption component suffered a slowdown for the second consecutive year, reaching a 2.1% growth in 2016, compared with 3.2% observed in the previous year, and 4.3% in 2014 (Graph 7). This decrease is mainly due to the decrease in durable goods consumption (-0.8%), lower than the 5.1% registered a year ago. This slowdown in household consumption was reflected in the strong contraction suffered by the consumer confidence index calculated by Fedesarrollo, which reached the lowest levels in the first quarter of 2017 since the measurement is made. This behavior is due to poor economic expectations of the households surveyed, as well as a poor perception of the current economic conditions.

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2   See minutes of the Bank's Board of Directors meeting of April 28, 2017.

After suffering significant supply shocks in the first half of 2016, Colombia registered declines in inflation in the second half of the year, driven by a 200 basis points increase in the central bank's intervention rate.

The general prices level of the Colombian economy starter its adjustment path in the second half of 2016. Delay in harvest decisions by farmers, lags of *El Niño* phenomenon effects, and the depreciation of the Colombian peso, as well as the activation of some indexation mechanisms, caused the growth of the Consumer Price Index (CPI) to be close to 9.0% in the first half of the year. As a response to the above, *Banco de la República* increased the benchmark rate by 200 basis points (bp) between January and August of 2016, situation that allowed an adjustment in demand and the following drop in inflation, which by February 2017 was at 5.2%.

Considering the slowdown the Colombian economy is experiencing right now, and from a financial stability point of view, it is relevant to study the resilience of the Colombian financial system in a household consumption and investment deterioration environment, together with changing conditions in the external context. For this reason, this report presents a sensitivity test that seeks to estimate the potential impact of a hypothetical scenario that includes a slowdown in the local economic activity, which results in a lower payment capability for some economic sectors, framed in external financing increased costs and a weak global demand. Likewise, the materialization of a set of risks to the banking system (credit, market, and liquidity risks) which could materialize as a result of the previous shock, is aimed for measuring. The usefulness of the test is to provide an estimate of the potential losses that would be observed in this scenario, and reveal the possible transmission channels through which the identified vulnerabilities could end up affecting financial stability.

Test results suggest that the impact of the hypothetical scenario on the capital adequacy of the entire banking system would have a moderate magnitude; despite the foregoing, there are decreases in profitability levels and loan portfolio dynamics. This highlights the need to continue with the careful monitoring, both of the financial situation of debtors and entities, as of international finance changing conditions. It is important to highlight that these results are obtained from a hypothetical scenario, and using a set of restrictive assumptions. Thus, it is to be expected that under shocks of lesser magnitude or using weaker assumptions, the impact on financial stability would be presumably less.

II. VULNERABILITIES OF THE FINANCIAL SYSTEM

Given the potential risks that have been identified in the macroeconomic environment, it is relevant to assess financial intermediaries' exposure to these potential vulnerability sources. In a context of economic slowdown, the financial system has been adjusting to recent macroeconomic shocks, which has led to gradual deterioration of the risk indicators. Therefore, this section presents an overview of the financial system, and discusses each of the risks (credit, market and liquidity risk) to which financial institutions are exposed to.

A. CURRENT STATUS OF THE FINANCIAL SYSTEM

Credit institutions assets showed a real decline due to the slowdown in the loan portfolio and investments.

By February 2017, credit institutions assets had a 2.4% real annual growth rate,[3] and reached $ 578.5 trillion (t). This item mainly consists of loan portfolio (70.7%) and investments (17.9%). On the other hand, the real annual growth of the total loan portfolio with securitizations was at 1.2%, 1.3 percentage points (pp) less than six months ago. By loan portfolio type, the declining trend exhibited by commercial credits in the past six months is highlighted (presenting real annual contractions)[4], while the consumption and microcredit ones showed accelerations (Graph 8). Gross loan portfolio with securitizations amounted to $ 412.7 t, on where the commercial loan portfolio continues to be the modality with the greatest share (56.2%), followed by consumption (27.8%), housing with securitization (13.3%) and microcredit (2.8%).

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3   Real growths were calculated using the consumer price index (CPI) without food.

4   Low growth rates featured in the second half of 2016, incorporate the effect of the absorption of *Leasing Bancolombia* by *Bancolombia* in October 2016, due to the fact that the $1.5 trillion credit that the financing company had with the bank ceases to be accounted for in the aggregate gross loan portfolio. Gross loan portfolio real growth would have been 70 basis points (bp) greater if the merger had not taken place.

Graph 8
Credit institutions gross loan portfolio annual real growth by modality
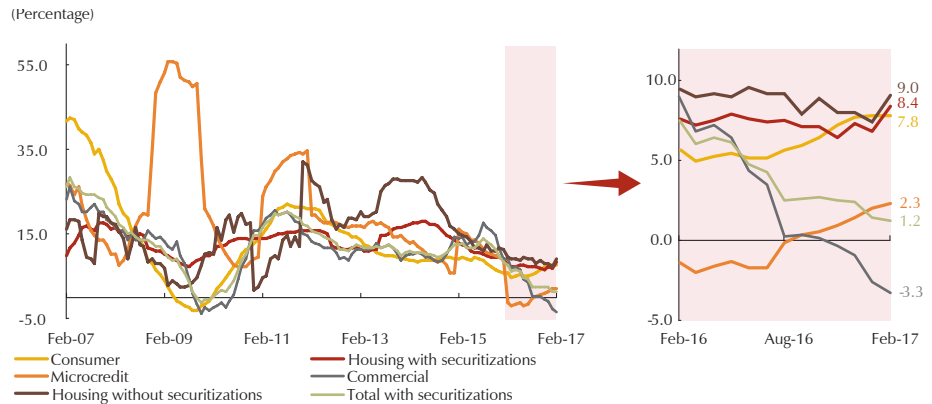
(Percentage)

— Consumer
— Microcredit
— Housing without securitizations
— Housing with securitizations
— Commercial
— Total with securitizations

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

On the other hand, credit risk indicators presented increases for all modalities.

The risk quality indicator[5] continued showing increases for all modalities during the last six months, reaching a 8.9% level in February 2017. This value corresponds to the highest observed since July 2010; however, it is below the levels recorded during 2009. This behavior is mainly explained by the dynamics of the indicator for the commercial loan portfolio, which showed an increase of 2.3 pp in the last six months, reaching 10.1%, the highest figure observed since the end of 2004 (Graph 9, Panel A). In the same way, the risk loan portfolio presented higher real growth rates, reaching 33.2% in February of 2017, 15.5 pp more than what was observed in August 2016.

On the other hand, the non-performing loan indicator[6] has shown an increasing trend since December 2015, reaching 4.2% in February 2017, the highest level since August 2010 (Graph 9, Panel B). By modality, the non-performing loan indicator

Graph 9
Credit risk indicators

A.   Commercial

(Percentage)

— Commercial   — Consumer   — Housing a/   — Microcredit   — Total

B.   Non-performing loan indicator

(Percentage)

— Commercial   — Consumer   — Housing a/   — Microcredit   — Total
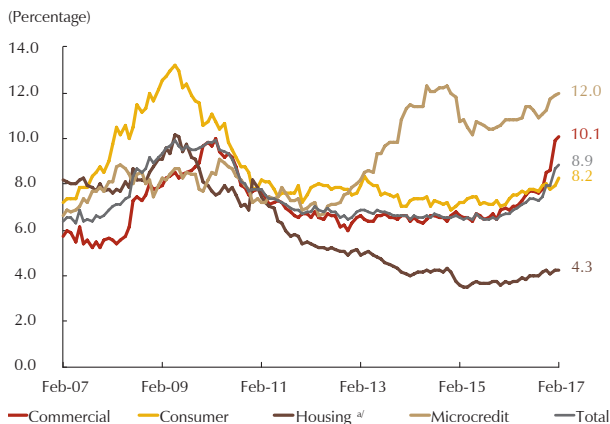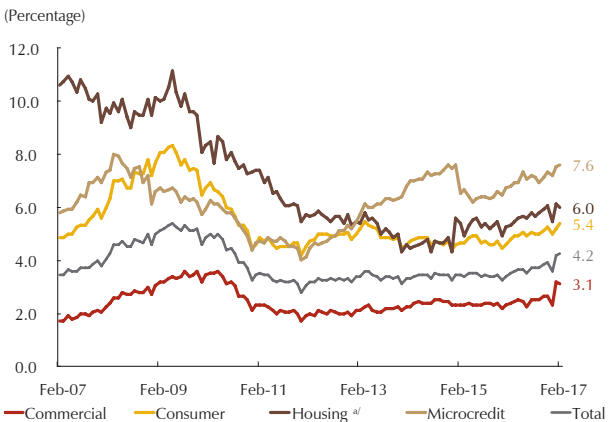
a/ Housing loan portfolio does not include securitizations.
Source: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República*.

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5   Risk Quality indicator is defined as the ratio between the risk loan portfolio and the total one (risk loan portfolio corresponds to all credits with a grade other than A, on a scale from A to E, where A is the best ranked).

6   The non-performing loan indicator is calculated as the ratio between the non-performing loan portfolio and the total one (non-performing loan portfolio includes loans which payments are past due for thirty days or more).

of the commercial loan portfolio, which increased 62 basis points (bp) between August 2016 and February 2017 is highlighted[7]. In addition, the total non-performing loan portfolio presented an acceleration starting in June 2016, reaching a real annual growth of 23.5% to February 2017. This behavior has been lower than in the risk loan portfolio one, which could be associated to that entities credit risk perception has increased at a higher rate than its materialization.

Despite the real decline in investment, its composition has remained relatively stable.

Credit institutions investments[8] have declined in the last year, registering a 7.7% real annual decrease by February 2017, reaching $ 103.61 t. The composition of this item has remained stable, on where TES, securities form domestic and foreign issuers are the assets with the largest share, by representing 38.0%, 22.0%, and 14.7% of the investments total respectively (Graph 10).

Graph 10
Investment type as a proportion of the total investment by February 2017
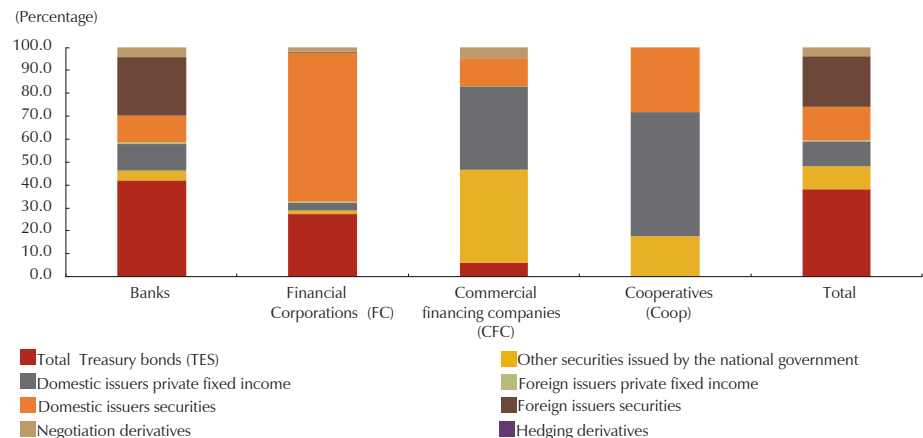
(Percentage)

■ Total Treasury bonds (TES)	■ Other securities issued by the national government
■ Domestic issuers private fixed income	■ Foreign issuers private fixed income
■ Domestic issuers securities	■ Foreign issuers securities
■ Negotiation derivatives	■ Hedging derivatives

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

Credit institutions liabilities continued the declining trend presented since the second half of 2016. By composition, term deposit certificates (CDTs) of a longer maturity continued increasing their share.

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7   According to the Colombian Financial System Current Report *(Informe de Actualidad del Sistema Financiero Colombiano)* of February 2017 from the Office of the Financial Superintendent of Colombia, the increase in the non-performing loan indicator for the commercial loan portfolio is associated, in part, with large am ounts specific obligations maturity, observed between the last quarter of 2016 and early 2017.

8   Investment includes derivatives operations.

Graph 11
Credit institutions liabilities composition

(Percentage)
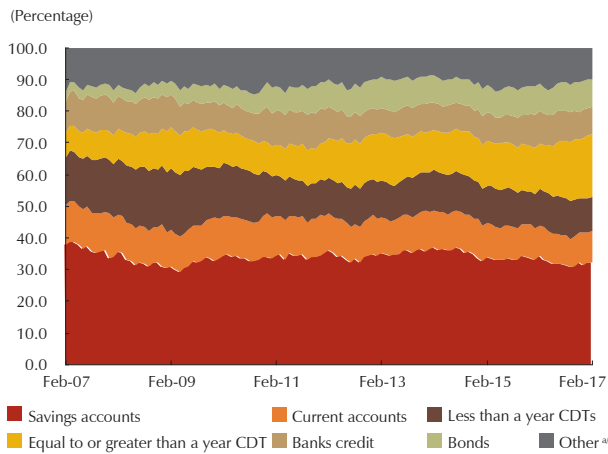
a/The following accounts are found in this category: interbank funds, bankers acceptance, accounts payable, estimated liabilities and provisions, and other liabilities.
Source: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República*.

Credit institutions liabilities were at $ 497.9 t in February 2017, registering a -2.2% annual real growth. In terms of its composition, there was a greater share of certificates of deposits (CDT) issued with a term greater than or equal to one year and of savings accounts in the last six months (from 18.2% and 31.2% in August 2016, to 19.7% and 32.2% in February 2017). On the contrary, a lower share of less than one year CDTs and other liabilities was observed, which decreased by 1.0 percentage points and 1.3 percentage points respectively, closing at 10.9% and 9.8% respectively (Graph 11).

Profitability indicators showed lower levels between August 2016 and February 2017, while capital ratio indicators increased.

The return on equity (ROE) indicator amounted to 15.4% in February 2017, showing a 64 basis points decrease in the last six months. On the other hand, return on assets (ROA) ended in 2.1%, decreasing 10 bp in the same period. With respect to total capital and common equity tier 1 capital ratio indicators, there was a 40 bp increase between August 2016 and February 2017 for both indicators, reaching 15.8% and 10.4% in that order[9].

For non-banking financial institutions, as evidenced for credit institutions, slowdown in assets real growth rate is highlighted.

Non-banking financial institutions proprietary positions assets between August 2016 and February 2017 was at $ 72.9 t, and accounted for 5.1% of assets in the financial system (Table 2). Its real annual growth was of 0.7%, a figure lower by 1.8 pp to what was registered in August 2016. The slowdown was mainly explained by insurance companies and pension funds managers behavior, which recorded rates of 0.4% and -2.2% respectively, compared to 6.6% and 0.7% observed six months ago. The slowdown in the proprietary position total was compensated by the better dynamics of stock brokerage firms, which recorded the highest growth up to the date of analysis (10.5% compared to -38,7%).

Regarding the portfolio managed by non-banking financial institutions as of February 2017, the balance amounted to $ 684.0 t, equivalent to 47.6% of the

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9   Regulatory limits for total capital and common equity tier 1 capital ratio, are 9.0% and 4.5% respectively.

Table 2
Non-banking financial institutions proprietary and managed position assets

Non-banking financial institutions assets	Aug-16			Feb-17		
	Trillion Colombian pesos	Financial System's Assets percentage	Annual real growth	Trillion Colombian pesos	Financial System's Assets percentage	Annual real growth
Proprietary position	**71.1**	**5.1**	**2.5**	**72.9**	**5.1**	**0.7**
Pension and severance funds managers	5.0	0.4	0.7	5.1	0.4	(2.2)
Trust companies	2.9	0.2	3.2	2.8	0.2	0.2
Stock brokerage firms	3.4	0.2	(38.7)	4.0	0.3	10.5
Insurance companies	59.8	4.3	6.6	60.9	4.2	0.4
Managed portfolio	**641.9**	**46.0**	**8.3**	**684.0**	**47.6**	**7.7**
Mandatory pensions	189.6	13.6	5.3	197.0	13.7	4.3
Voluntary pensions	14.8	1.1	2.6	15.5	1.1	2.4
Severance funds	10.3	0.7	4.8	13.7	1.0	2.2
Trust Companies	410.2	29.4	8.1	439.0	30.5	9.2
Stock brokerage firms	17.0	1.2	29.7	18.8	1.3	20.9
Non-banking financial institutions total[a]	**713.7**	**51.1**	**7.7**	**757.5**	**52.7**	**7.0**
Financial system total	**1,395.7**	**100.0**	**6.8**	**1,438.2**	**100.0**	**0.9**

Note: Data expressed in February 2017 Colombian pesos.
a/ Includes assets from other securities intermediaries.
Source: Office of the Financial Superintendent of Colombia; Calculations by Banco de la República.

system's assets. Regarding August 2016, there has been a slowdown in these assets expansion rate, from 8.3% to 7.7%. By type of entity, all portfolios, except for the one managed by trust companies, showed slowdowns; however, growth rates are higher than that recorded for the financial system's assets total.

As for the composition of non-banking financial institutions' portfolio, most entities concentrate their investments primarily in public and private debt from domestic issuers, both for proprietary as for managed positions.

Regarding non-banking financial institutions proprietary position investments as of February 2017, these were mainly concentrated in the private (40.6%) and public (29.3%) debt local market, as well as in domestic issuers securities (20.0%; Graph 12, panel A). By type of entity, participation of investments in TES by stock brokerage firms is highlighted (70.7%), while trust companies and pension funds managers concentrated their portfolio in domestic securities (74.9% and 73.6% in that order).

Managed portfolios investments were concentrated in TES (38.5%), domestic issuers securities (22.5%) and private fixed-income securities (21.9%, Graph 12, panel B). In the case of mutual funds, a concentration on private fixed-income securities from domestic issuers (71.6%) and in

Graph 12
Non-banking financial institutions portfolio composition

A.   Proprietary position
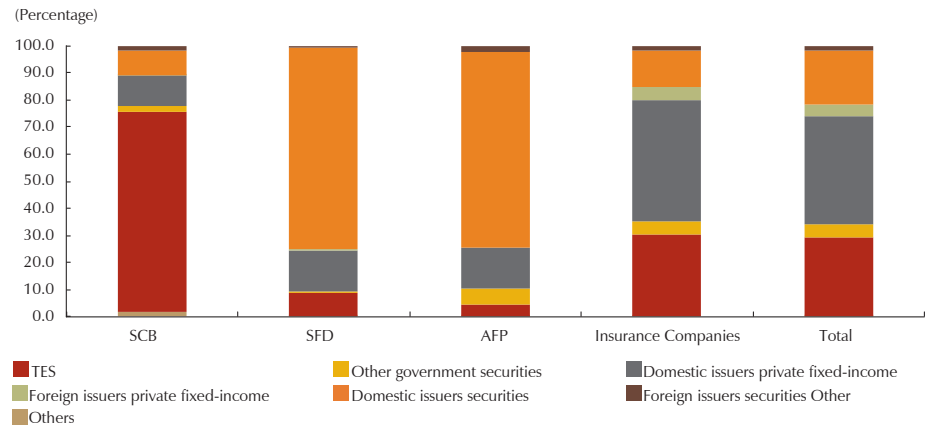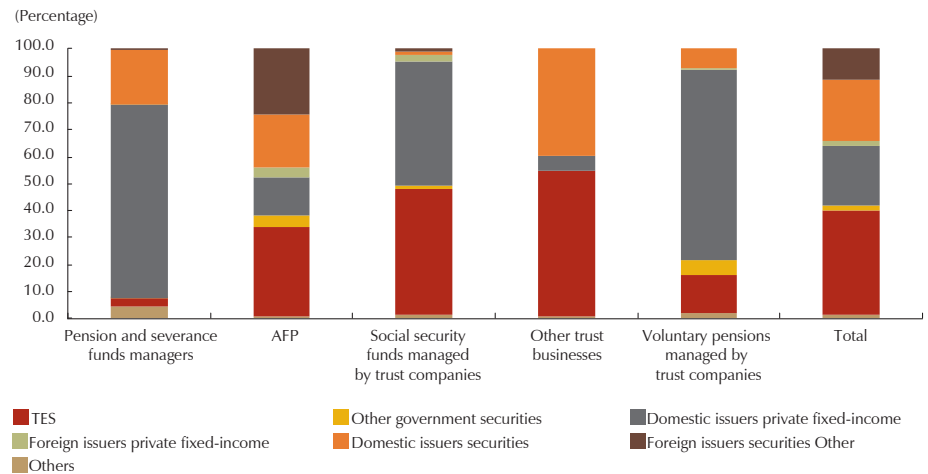
(Percentage)

■ TES   ■ Other government securities   ■ Domestic issuers private fixed-income
■ Foreign issuers private fixed-income   ■ Domestic issuers securities   ■ Foreign issuers securities Other
■ Others

B.   Managed position

(Percentage)

■ TES   ■ Other government securities   ■ Domestic issuers private fixed-income
■ Foreign issuers private fixed-income   ■ Domestic issuers securities   ■ Foreign issuers securities Other
■ Others

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

local securities (20.2%) is highlighted. On the other hand, resources from voluntary pensions and social security administered by trust companies were concentrated in private fixed-income securities from domestic issuers (70.5% and 46.5%, respectively), while the other trust businesses did, as well as in TES, in domestic securities (53.8% and 39.5% in that order).

Along with the slower assets growth rate, debt and securities markets valuations in the local market during the second half of 2016 were reflected in an increase of the ROA for the different types of entities.

Finally, regarding non-banking financial institutions financial soundness, it is noted that stock brokerage firms and trust companies ROA has shown an increasing trend since the last quarter of 2015 and 2016 respectively (Graph 13, panel A). The behavior of these indexes for non-banking financial institutions

Graph 13
Non-banking financial institutions ROA

A. Trust and stock companies

(Percentage)   (Percentage)

— Stock brokerage firm   — Trust companies (right axis)

B. General and life insurance companies

(Percentage)
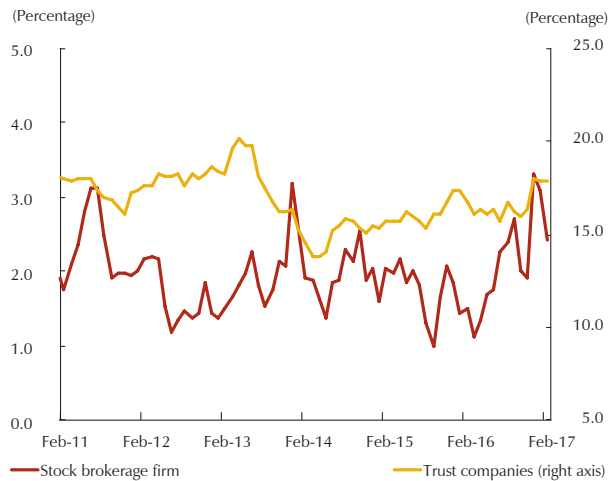
— General insurance   — Life insurance
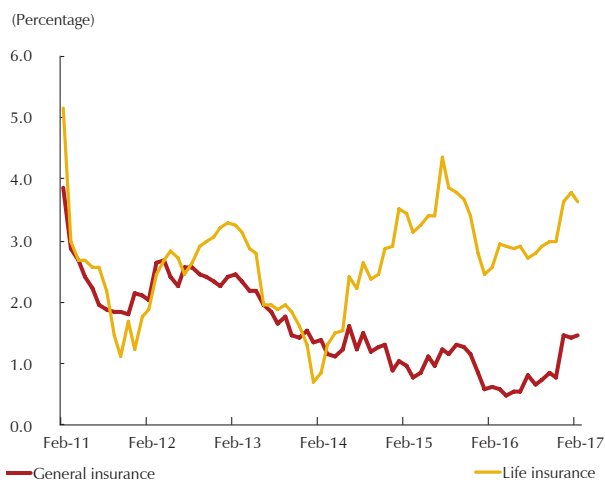
C. Pensions funds managers
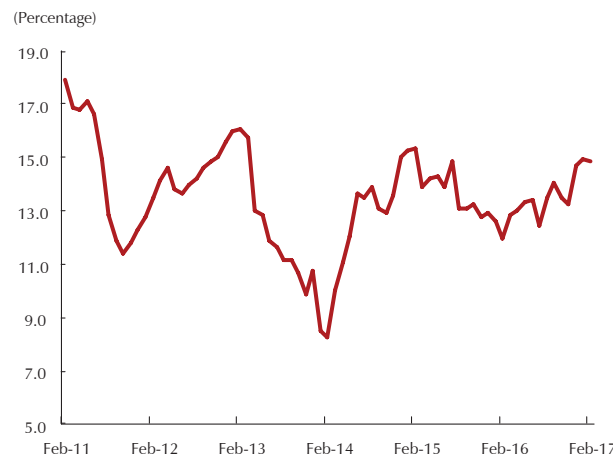
(Percentage)

responded to the increase in profits, result of the net appreciation of debt and national securities markets investments. The above was also reflected in general and life insurance companies and pension funds managers profitability indicators, which showed an increasing trend since mid-2016, and were at 1.5%, 3.6% and 14.9% respectively in February 2017 (Graph 13, Panels B and C).

B. CREDIT RISK

The credit risk analysis featured below is divided into the corporate and household sectors. The first subsection analyzes the evolution of corporate sector debt, as well as the perception and materialization of private companies' credit risk, by economic sector. The second subsection identifies households' financial burden and features some expectations indicators, which are related to loan portfolio behavior.

1. Corporate Sector[10]

Considering that, as of December 2016, loans granted to companies (commercial and microcredit) amounted to $ 243.2 trillion, and had a 59.8% share of the credit institutions' total loan portfolio, it is important to assess the financial soundness of these debtors and to make a follow-up on the performance of these loans, in order to foresee potential risks on the stability of the financial system. With this objective, this section analyzes the debt these agents have by funding instrument and currency type, and a sectorial analysis in which several credit risk indicators by economic industry are included, in order to identify sectors that, given a less favorable economic environment, are experiencing or may experience difficulties in complying with the timely payment of their obligations.

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10   Due to data availability, figures in this section are featured by December 2016 as closing date.

Graph 14
Financial debt of the corporate sector as percentage of GDP, by instrument

A.   Private Corporate Sector

(Percentage)

Foreign suppliers
Foreign issued bonds
Credit with foreign financial institutions
Credit in legal tender with domestic financial institutions

Domestic suppliers a/
Bonds issued in the local market
Credit in foreign currency with domestic financial institutions b/
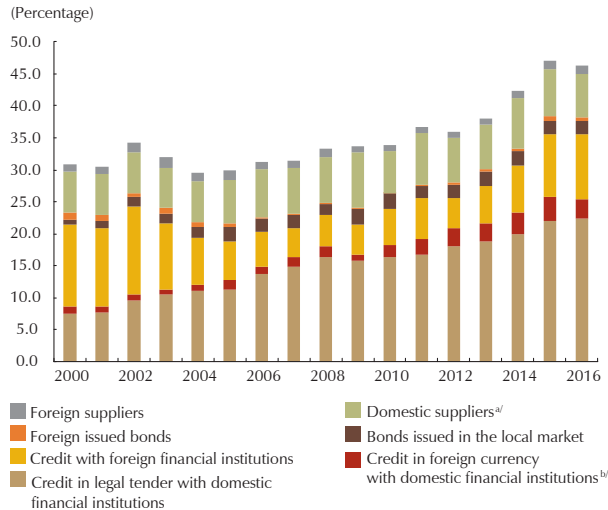
a/ Only includes information of companies reporting their financial statements to Office of the Superintendent of Corporations of Colombia. In 2015, 2,362 companies began to register their financial statements using the IFRS, which did not allow the identification of these agents' debt balance with domestic suppliers. Therefore, for making an approach of the debt balance of these companies with domestic suppliers, we calculated, for companies that registered statements using the Mandatory Chart of Accounts (PUC in Spanish), the percentage that short and long-term suppliers represent of their current and non-current liabilities, respectively, and a similar percentage was assumed for enterprises that submitted statements using the IFRS. Due to data availability, the domestic suppliers' balance for December 2016 is assumed equal to the one calculated for December 2015.
Sources: Office of the Financial Superintendent of Colombia, Office of the Superintendent of Corporations of Colombia and *Banco de la República*; Calculations by *Banco de la República*.

B.   Sector corporativo público

(Percentage)

Multilateral entities
Foreign suppliers
Foreign issued bonds
Credit with foreign financial institutions a/
Credit in legal tender with domestic financial institution

Bilateral Entities
Domestic suppliers b/
Bonds issued in the local market
Credit in foreign currency with domestic financial institutions

a/ Does not include financial leasing operations.
b/ Includes information of accounts payable of the main non-financial companies of the public sector.
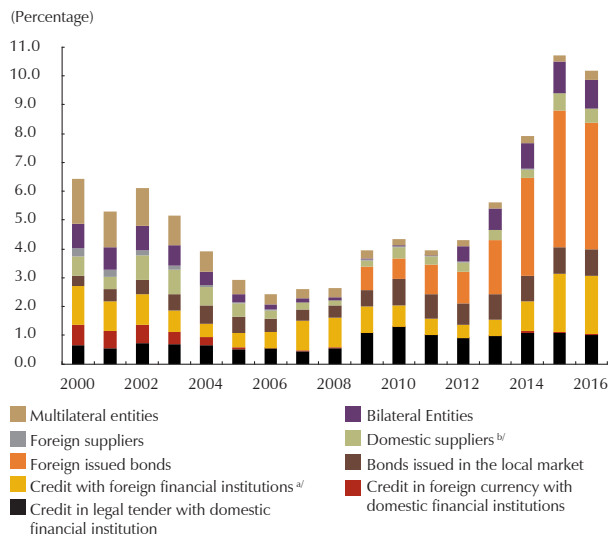Sources: Office of the Financial Superintendent of Colombia, General Accounting Office (Contaduría General de la Nación), Ministry of Finance and Public Credit; Calculations by *Banco de la República*.

a.   *Corporate sector debt evolution*

Both private and public corporate sectors presented a decrease in debt as percentage of GDP, between December 2015 and the same month of 2016.

Corporate sector debt analysis is important because it allows identifying, not only possible overleveraging situations, but also the dependency degree to a particular funding source, which can compromise the compliance of these agents' obligations with the financial system.

Private corporate sector debt as GDP proportion was at 56.4% in December 2016, presenting a reduction of 1.3 percentage points when compared to 2015. The private corporate sector[11] contributed with 46.2 percentage points to the total share, and the public non-financial corporate sector with the remaining 10.2 percentage points. When analyzing the two sectors separately, it is found that both had a lower debt as GDP proportion, compared to the observed a year earlier, reversing the increasing trend recorded since 2012.

The decline experienced by the private sector was mainly because debt in foreign currency with domestic financial institutions decreased and, to a lesser extent, that funding with foreign suppliers was reduced because of the exchange rate appreciation effect. On the other hand, public sector debt behavior was specially explained by a lower balance of bonds issued overseas (only because of the appreciation affect) and, to a lesser extent, by a reduction in debt with domestic financial institutions and in the debt balance with bilateral entities, the latter solely due to the appreciation of the exchange rate (Graph 14).

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11   Throughout this section, the term "private corporate sector" refers to private companies, excluding those that are supervised by the Office of the Financial Superintendent of Colombia.

Graph 15
Financial debt of the corporate sector as percentage of GDP,
by currency

A.   Private Corporate Sector

(Percentage)
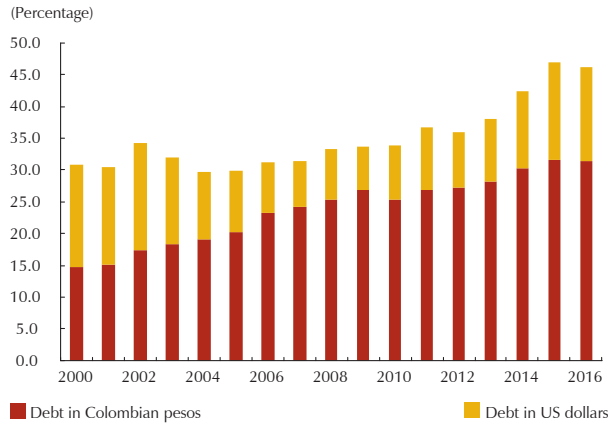
Note: prepared with the same information from Graph 14, panel A.
Sources: Office of the Financial Superintendent of Colombia, Office of the Superintendent of
Corporations of Colombia, and *Banco de la República*; calculations by *Banco de la República*.

B.   Public corporate sector

(Percentage)
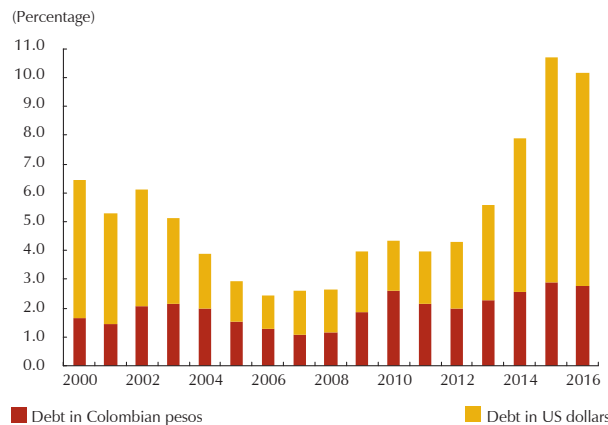
Note: made with the same data as Graph 14, panel B.
Sources: Office of the Financial Superintendent of Colombia, General Accounting Office
(Contaduría General de la Nación), Ministry of Finance and Public Credit; Calculations by
Banco de la República.

In addition to the above, it is noted that as of December 2016 the main funding sources of the private sector continue to be loans with local and foreign financial institutions, while bonds issued in the foreign market are the ones for the public sector. Also, it can be seen that the least demanded funding sources by private companies are bonds issued abroad, and for public firms the least demanded are foreign suppliers.

Debt in Colombian pesos of both the private and public corporate sectors as percentage of GDP remained relatively stable, while debt in US dollars declined, primarily because of the appreciation of the exchange rate.

When analyzing debt by currency type, it is noted that private companies still acquire most of their debt in Colombian pesos (67.8% of the total share, which is equal to 31.4% of 2016 annual GDP), while public firms have preferred to get into debt in US dollars (72.6% of the total debt, which corresponds to 7.4% of 2016 annual GDP, Graph 15).

It should be noted that the increase observed between 2013 and 2015 of US dollar denominated debt for both groups, was mainly due to the exchange rate depreciation effect that occurred since the second half of 2014. However, between December 2015 and the same month of 2016 this trend was reversed. In the case of private companies, the reduction of debt in US dollars as percentage of GDP was of 53 basis points, explained completely by appreciation[12]. In contrast, for public companies, such decline was of 47 basis points, and the price effect contributed with 37 basis points.

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12   Assuming that the exchange rate of late 2015 had remained constant, a 21basis points increase
will have been observed in debt in dollars as percentage of GDP..

c.   *Sectorial analysis[13]*

Between December 2014 and the same month of 2016, the economic sectors of construction, real estate, and electricity increased their share in loans granted to companies from the private corporate sector, while wholesale and retail, manufacturing, and transportation activities experienced a reduction.

Within a context of local economic activity slowdown, partly explained by a real contraction in gross capital formation, it is necessary, in terms of financial stability, to analyze the performance of the commercial loan portfolio by economic sector, with the aim of identifying those that have been affected by this dynamics and, thus, may experience difficulties to timely fulfill their obligations.

Graph 16
Composition of the private corporate sector's loan portfolio by economic sectort

a/ Entities supervised by Office of the Financial Superintendent of Colombia are excluded from the financial activities and insurance sector.
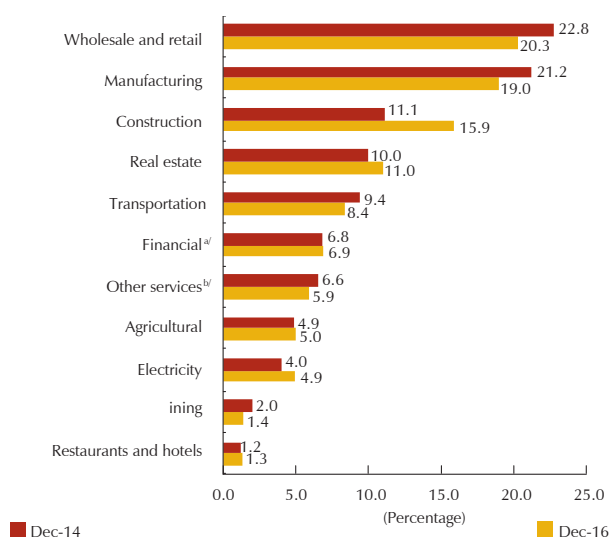b/ 'Other services' gathers firms belonging to the following economic sectors: public administration and defense, education, social and health services, other community, social and personal services activities, private households with domestic servants, and the organizations and extraterritorial organs
Sources: Office of the Financial Superintendent of Colombia, Office of the Superintendent of Corporations of Colombia and *Banco de la República*; Calculations by *Banco de la República*.

By December 2016, economic sectors with the greatest share in the loan portfolio granted to private companies were wholesale and retail, manufacturing and construction, which together concentrate 55.2% of the loan portfolio. On the other hand, hotels and restaurants, mining and electricity are the ones with the lowest shares (7.7% of the loan portfolio granted to private corporate sector companies).

Between 2014 (year in which the process of depreciation of the Colombian peso against the U.S. Dollar began and the sharp drop in oil prices started) and 2016, the economic sectors of wholesale and retail, manufacturing and transportation were the ones with the greatest reductions in the total share. On the other hand, real estate, electricity, and construction increased their share, highlighting the increase in the latter by 4.8 percentage points (Graph 16). The rise exhibited by construction is explained by the fact that the loan portfolio of this industry increased by approximately COP 10.0 trillion between the first and second quarters of 2015. In this lapse, 9,297 new debtors focused on this economic activity emerged, which explain COP 9,6 trillion of the increase. Of these new debtors, 721 are trusts, which contributed with COP 7.0 trillion.

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13   In this subsection abbreviations will be used for the following sectors : 1) real estate, rental and business activities (real estate); 2) agriculture, livestock raising, hunting, forestry and fishing (agricultural); mining and quarrying (mining); 4) electricity, gas and water (electricity); 5) transportation, warehousing and communications (transportation), and 6) financial intermediation (financial).

The analysis of various indicators shows that the economic sectors in which the credit risk has increased the most are mining, electricity, transportation, and hotels and restaurants. These four industries account for 16.1% of the private corporate sector loan portfolio in December 2016.

Between December 2015 and the same month of 2016, credit risk indicators of the total commercial loan portfolio showed deterioration. The quality risk indicator exhibited an increase of 1.8 percentage points, registering a level of 8.6% at the end of 2016, while the increase in the non-performing loan ratio was milder, from 2.2% to 2.3%. From the above, it can be inferred that both credit risk perception and materialization have risen in the portfolio of these types of loans.

When calculating these indicators by economic industry, it is found that mining, construction, hotels and restaurants, other services, electricity and transport, have experienced significant increases in their quality risk indicator between December 2015 and the same month of 2016, highlighting the behavior of the two latter economic activities (Graph 17, panel A). Regarding the non-performing loan ratio, all sectors presented deterioration, with the exception of agriculture, construction, and financial activities. It is important to highlight the variation of the indicator for mining (from 5.1% to 9.3%), and for electricity (from 0.2% to 4.5%, Graph 17, panel B).

In order to extend the analysis of the behavior of loans disbursed to firms, three additional credit risk indicators of a prospective character, which allow for identifying higher vulnerability episodes for credit institutions, were calculated: 1) risk perception indicator by rating, 2) risk perception indicator by provisions and 3) probability of migrating to a lower rating.

The risk perception indicator by rating, which represents the percentage of the value of loans with a rating lower than the one they should have according to their delinquency days [14], continued with the growing trend showed since late 2015 for the total loan portfolio granted to the private corporate sector, registering a value of 6.8% in December 2016 (Graph 18, panel A). By economic sector, credit institutions are perceiving a greater risk in loans granted to mining, electricity, transport, hotels and restaurants, construction and financial firms (Graph 18, panel B).

The risk perception indicator by provisions is defined as the ratio between additional loan provisions that credit institutions constitute and a simulated provision that is calculated using the guidelines of the Credit Risk Management System of the

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14   According to Annex 1, chapter II of the Accounting and Financial Basic Circular from the Office of the Financial Superintendent of Colombia, commercial loans must be rated in accordance to their delinquency in the following way: 1) category A: credits with one month or less default, 2) category B: credits with more than one and up to three months default, 3) category C: credits with more than three and up to six months default, 4) category D: credits with more than six and up to twelve months default, and 5) category E: credits with more than twelve months default.

Graph 17
Credit risk indicators by economic sector

A.   Quality risk indicator by economic sector

(Percentage)

	Dec-14	Dec-15	Dec-16
Agricultural	16.0	15.5	16.3
Mining	9.9	28.6	33.0
Manufacturing	7.7	7.7	7.5
Electricity	1.1	0.9	18.8
Construction	6.3	6.6	8.2
Wholesale and retail	6.4	6.4	7.3
Restaurants and hotels	4.3	5.4	10.6
Transportation	9.7	11.4	16.4
Financial a/	3.2	4.8	4.9
Real estate	6.1	5.6	6.3
Other services b/	7.7	6.3	8.3
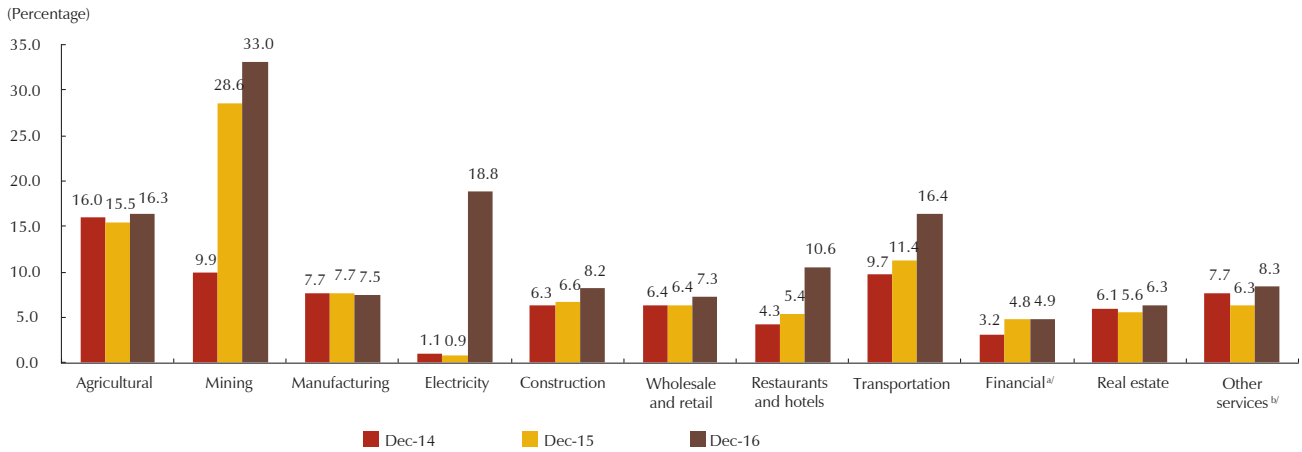
B.   Non-performing loans indicator by economic sector

(Percentage)

	Dec-14	Dec-15	Dec-16
Agricultural	5.1	6.0	5.2
Mining	4.5	5.1	9.3
Manufacturing	2.2	2.2	2.8
Electricity	0.0	0.2	4.5
Construction	2.7	2.9	2.7
Wholesale and retail	3.0	3.3	3.4
Restaurants and hotels	1.5	2.4	3.4
Transport	1.7	2.4	2.9
Financial a/	0.8	2.7	0.8
Real estate	2.7	2.2	2.8
Other services b/	1.9	1.6	2.3
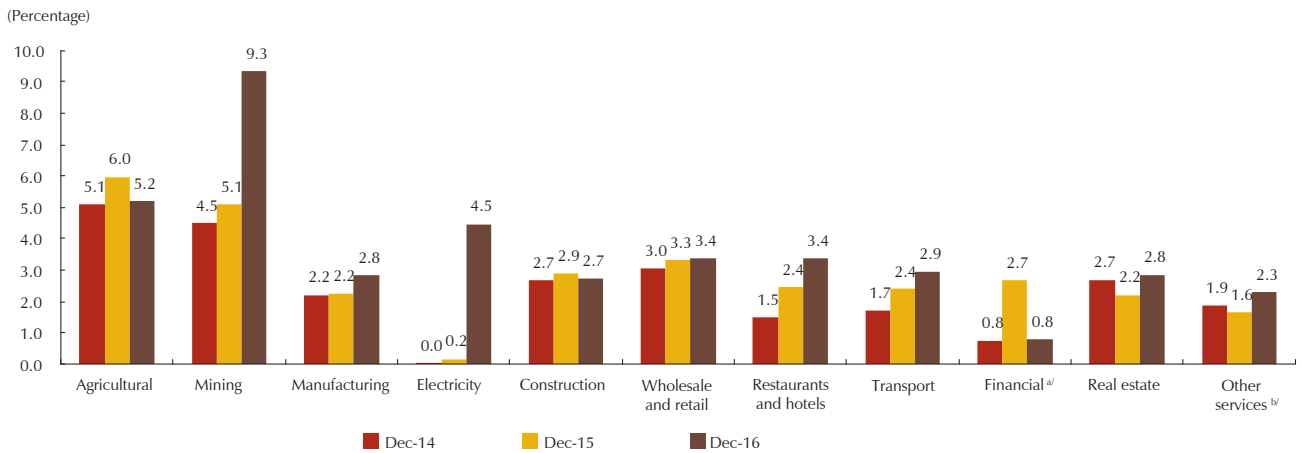
a/ The financial and insurance sector excludes the loan portfolio granted to institutions supervised by Office of the Financial Superintendent of Colombia.
b/ 'Other services' gathers firms belonging to the following economic sectors: public administration and defense, education, social and health services, other community, social and personal services activities, private households with domestic servants, and the organizations and extraterritorial organs.
Sources: Office of the Financial Superintendent of Colombia, Office of the Superintendent of Corporations of Colombia and *Banco de la República*; Calculations by *Banco de la República*.

Office of the Financial Superintendent of Colombia[15]. This proportion showed, in the same way, an increase in the last twelve months, reaching 17.4% in December 2016 (Graph 19, panel A). When assessing the sectoral behavior, a greater risk perception can be observed in transport, electricity, hotels and restaurants, wholesale and retail and agricultural sectors, results consistent with those obtained in the risk perception indicator by rating (Graph 19, panel B).

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15   Using the form 341 (active lending operations) of the Office of the Financial Superintendent of Colombia, the provision that credit institutions should have for each of their lending operations is simulated, and they are grouped by rating. The risk perception indicator by provisions is calculated with the simulated provisions balance in each moment of time as follows:

$$\text{Risk perception by provisions indicator} = \frac{\left(\sum_{X=A}^{E} outstanding_X\right) - \left(\sum_{X=A}^{E} simulated_X\right)}{\left(\sum_{X=A}^{E} simulated_X\right)}$$

Where the index X denotes the different ratings that lending operations can have, which can be any letter within the set {A, B, C, D, E}.

Graph 18
Risk perception indicator by rating

A. Total loan portfolio of the corporate sector
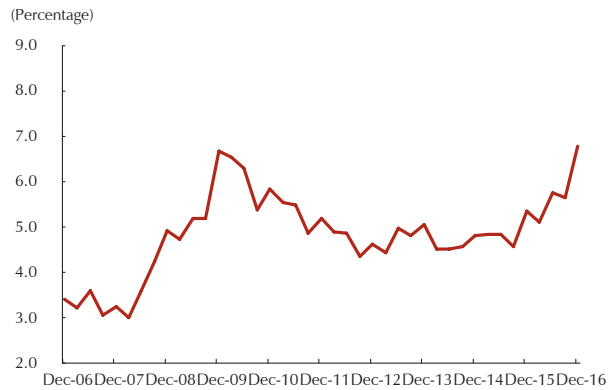
(Percentage)

B. By economic sector

(Percentage)   (Percentage)

- Transport
- Financial Activities
- Hotels and Restaurants
- Construction
- Electricity
- Mining (right axis)

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

Graph 19
Risk perception indicator by provisions

A. Total loan portfolio of the corporate sector

(Percentage)

B. By economic sector

(Percentage)

- Wholesale and retail
- ransportation
- Hotels and restaurants
- Electricity
- Agricultural

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

The probability of migrating towards a lower rating is calculated both by value of the loans and by number of operations[16]. In Panel A of Graph 20 it can be observed that both the aggregate probability by value and by number of operations, are exhibiting a growing trend since the first quarter of 2012. The increase in the indicator during this period has been significantly larger for the calculated probability by operations, which indicates that loans that have a greater probability
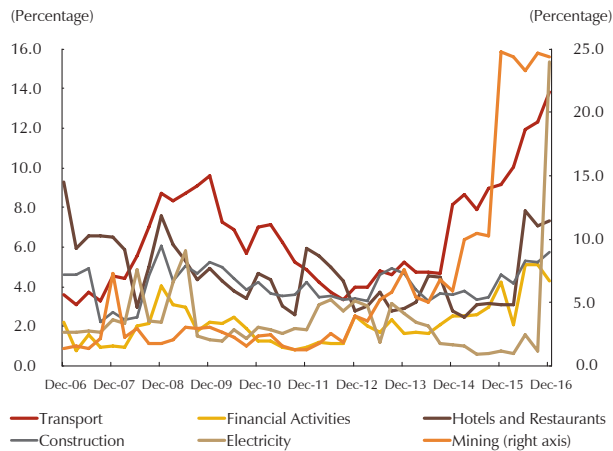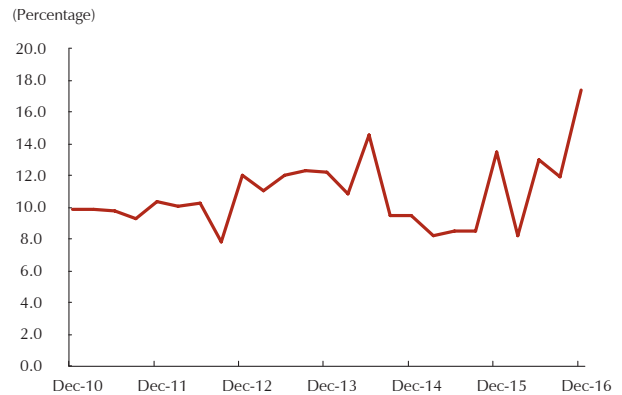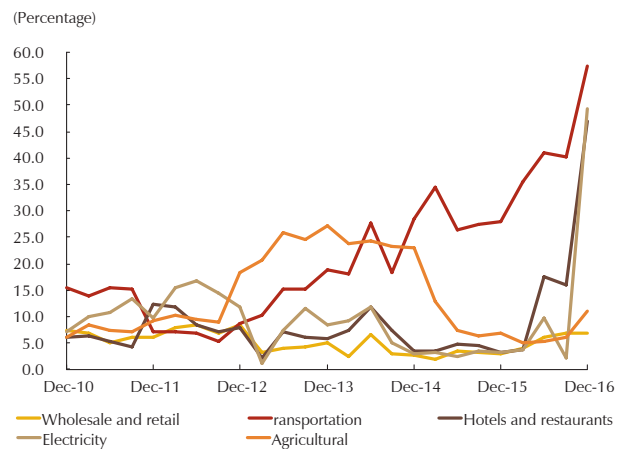
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16   This indicator is calculated using quarterly information of the 341 form (active lending operations) of the Office of the Financial Superintendent of Colombia. $P(X_{t-1})$ denotes the probability that a lending operation had been rated with the letter X in the quarter preceding the assessed quarter, and $P(AND_T | X_{t-1})$ the probability that a lending operation migrates to rate Y in the assessed quarter, given that it was rated with letter X in the previous quarter. Ratings for lending operations can be any letter within the set {A, B, C, D, E}, where A is the best rate and E the worst. Given this, the total probability in quarter t to migrate towards a lower rating is calculated as follows: $P(B_t|_{t-1})$ $1 \times \times P(A_{t-1}) + p(C_t|_{t-1}) \times 2 \times P(A_{t-1}) + p(D_t|_{t-1})$ $3 \times \times P(A_{t-1}) + p(e_t|_{t-1})$ $4 \times \times P(A_t\,1) + P(C_t|B_{t-1})$ $2 \times \times P(1)t\text{-}B + P(Dt|B_{t-1})$ $3 \times \times P(1)t\text{-}B + P(Et|B_{t-1})$ $4 \times \times P(1)t\text{-}B + P(D_t|c_{t-1})$ $3 \times \times P(C_{t-1}) +$ $P(E_t|c_{t-1}) \times 4 \times P(C_{t-1}) + P(Dt|D_{t-1})$ $3 \times \times P(D_{t-1}) + P(E_t|D_{t-1})$ $4 \times \times P(D_{t-1}) + P(E_t|E_{t-1})$ $4 \times \times P(E_{t-1})$. Note that it is a weighted probability, since the weighting factor (that goes between 1 and 4) is higher as the rating towards a loan migrates is lower.

Graph 20
Probability of migrating to a lower rating

A.   Total loan portfolio of the private corporate sector
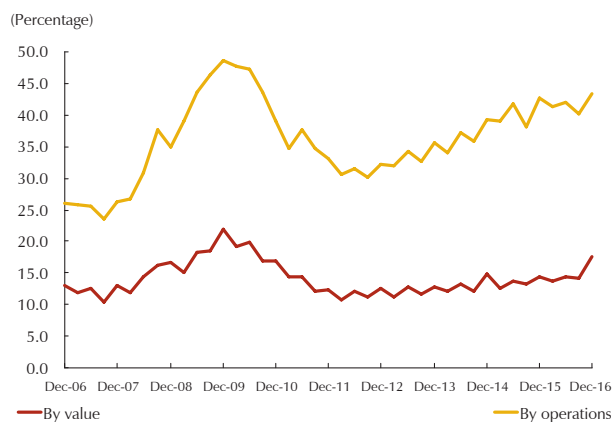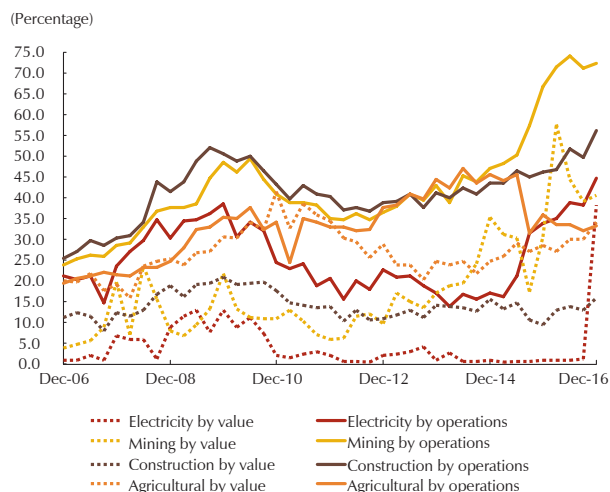
(Percentage)

B.   By economic sector

(Percentage)

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

to migrate towards lower ratings are those with the lowest amounts. However, during the last quarter of 2016, deterioration of the two indicators was similar, which means that between September and December of that year, loans of large amounts also migrated to lower ratings.

When performing the same analysis by economic industry, it can be noted that mining, construction and electricity show increases in probability during the last year, both by value and number of operations,, while the agricultural sector exhibits increases only by value. This situation has been reflected in the risk perception indicators analyzed previously (Graph 20, panel B).

2.   Households

The study of household debt within financial stability analysis, is relevant due to credit institutions increased exposure to this sector; in fact, in February 2017 the loan portfolio destined to these agents[17] registered a level of $ 165.6 trillion, which accounted for 40.5% of the total loan portfolio of these institutions, a percentage higher to that of August 2016 (39.1%). Considering this larger exposure, and with the aim of assessing possible difficulties for the financial system performance because of a possible default from families, this section features a comprehensive analysis of this sector, which includes not only its debt dynamics, but also its payments behavior, expectations and financial burden level.

Colombian households' debt level increased between August 2016 and February 2017, with the modality of consumption showing the largest growth.

A more accurate measurement of these agents' debt levels includes, in addition to credit institutions consumption and household loan portfolio, that granted by the National Savings Fund (FNA in Spanish) and the solidarity sector

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17   Household loan portfolio means the sum of consumption and mortgage loan portfolios.

Graph 21
Household debt composition and annual real growth

(February 2017 trillion Colombian pesos)   (Percentage)
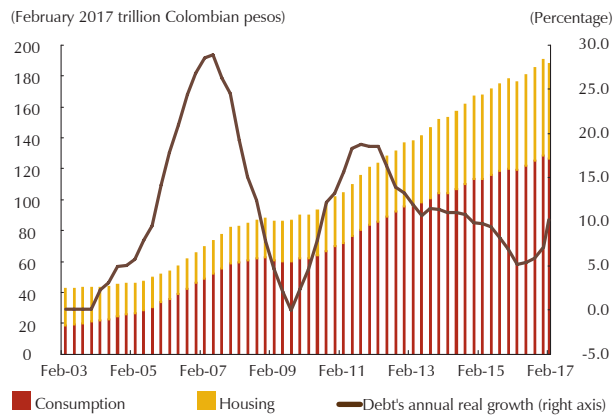
Sources: *Superintendencia Financiera de Colombia* (Office of the Financial Superintendent of Colombia) *Superintendencia de la Economía Solidaria* (Office of the Superintendent of Solidary Economy) and *Titularizadora de Colombia* (Colombian Securitization); Calculations by *Banco de la República*.

-savings and credit cooperatives (CAC in Spanish) and employee funds-[18]. This way, by February 2017 households' total debt amounted to $ 187.5 trillion, of which 67.4% was on consumer loans, and the remaining 32.6% to housing[19] (Graph 21). The real annual growth of this debt was at 10.2%, keeping with the growing trend presented since mid-2016. In February 2017, household debt accounted for 21.5% of GDP and 32.5% of the disposable income of these agents, calculated by the National Administrative Department of Statistics (DANE in Spanish)[20].

Compared to August 2016, consumption modality is the one showing largest acceleration (from 5.5% to 11.0%). In the case of credit institutions, personal loans and credit cards, participating with 23.4% and 21.6% within this loan portfolio, recorded the highest growth rates in February (10.0% each)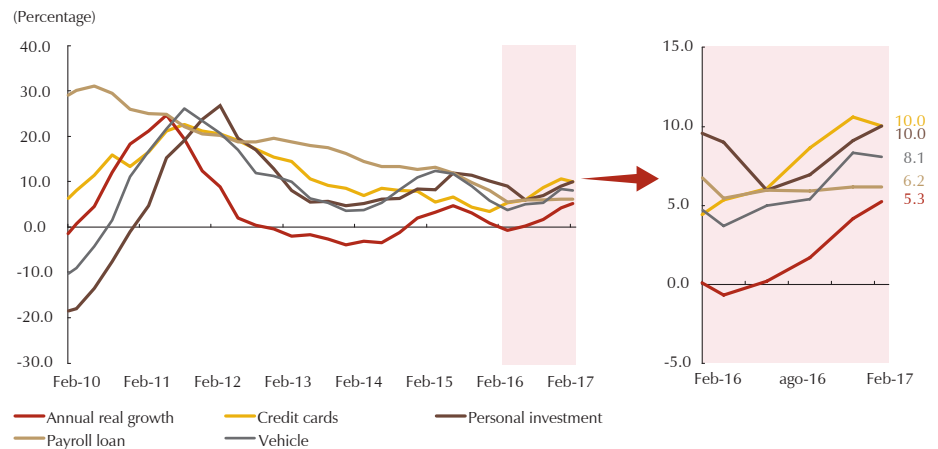. In addition, revolving loans increased from 1.3% to 5.3% in the last six months; these types of loans represent 5.3% of consumption total loan portfolio (Graph 22).

Graph 22
Consumer loans by modality: annual real growth

(Percentage)

Sources: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República*.

18   This estimation does not include family compensation funds data.

19   Housing loan portfolio includes securitizations total balance. For CAC's, the balance of mortgage loan and consumption for July, August and September of 2013 was estimated due to information problems. As for employee funds, given that data is annual, it was assumed that loans balances grew at the same quarterly rate during the course of each year.

20   Gross Domestic Product (GDP) used corresponds to the nominal value of December 2016. Disposable income is taken from DANE's integrated economic accounts, which are available up to 2015. Disposable income forecasts of 2016 and 2017 were calculated assuming that it expands at the same nominal GDP rate, minus the average historical difference between both variables growths.

On the other hand, mortgage loan portfolio passed from growing 6.4% to 8.6% over the analysis period, mainly explained by the dynamics of the credit institutions loans denominated in real value units (UVR in Spanish), participating with 20.4% of this loan portfolio total[21] Within this last category, social housing loans (VIS in Spanish) increased from 8.5% to 9.8% between August 2016 and February 2017, while those for other than VIS did from -4.2% to 5.2% over the same period (Graph 23). In contrast, the growth rate of loans in Colombian pesos destined to housing other than VIS decreased, while that of VIS remained relatively stable over the same period.

Graph 23
Mortgage loans by modality: annual real growth
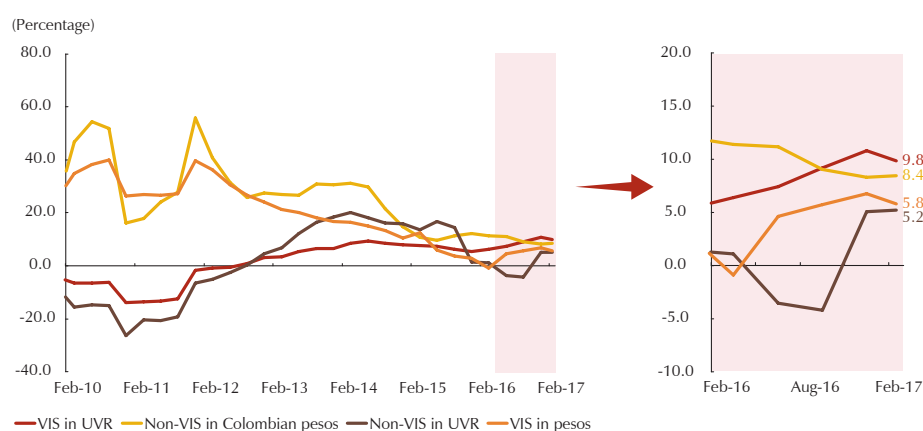
(Percentage)

- VIS in UVR - Non-VIS in Colombian pesos - Non-VIS in UVR - VIS in pesos

Sources: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República*.

Complementary to the above, the average growth of the consumption loan portfolio disbursements was at 3.5% in February 2017, stressing that in the past six months the revolving and personal investment loans exhibited the greatest acceleration. In the mortgage loan portfolio case, disbursements recorded an average growth of 2.2%, on where loans denominated in UVR showed the largest increase.

Consumer and mortgage loan portfolios quality risk and non-performing loan indicators showed deterioration in the same period, featuring some vulnerabilities in personal investment, vehicle, and revolving loans subcategories[22].[22]

21   These loans denominated in UVR growth does not appear to be being affected by the dynamics of this index, but for the increased demand for this type of loan. Between August 2016 and February 2017, the UVR went from growing 8.8% to 5.6%.

22   Due to data availability, featured risk indicators are only made based in credit institutions information. Nonetheless, it is considered as a good approach for households' total debt, since these entities represent 90.4% of the total.

In the case of consumption, an increase in the non-performing loan indicator for all loan types is noted. Between August and February, this indicator grew from 5.0% to 5.4% for the total consumer loan portfolio. Personal investment modality is still exhibiting the highest non-performing loan indicator, reaching 7.3%, while six months ago it was at 6.7% (Graph 24, panel A). As for mortgage loans, the non-performing loan indicator for the total mortagage loan portfolio slightly increased from 6.5% to 6.6%. Despite the fact that loans denominated in UVR continue showing the highest delinquency levels, their non-performing loan indicator decreased over the analysis period, while those denominated in Colombian pesos recorded increases (Graph 24, panel B).

The static pool analysis for the consumption modality during the fourth quarter of 2016 shows deterioration for some types of loans. For the personal investment case, it can be seen that the non-performing loan indicator for

Graph 24
Non-performing loan indicator

A.   Non-performing loan indicator by consumption modality
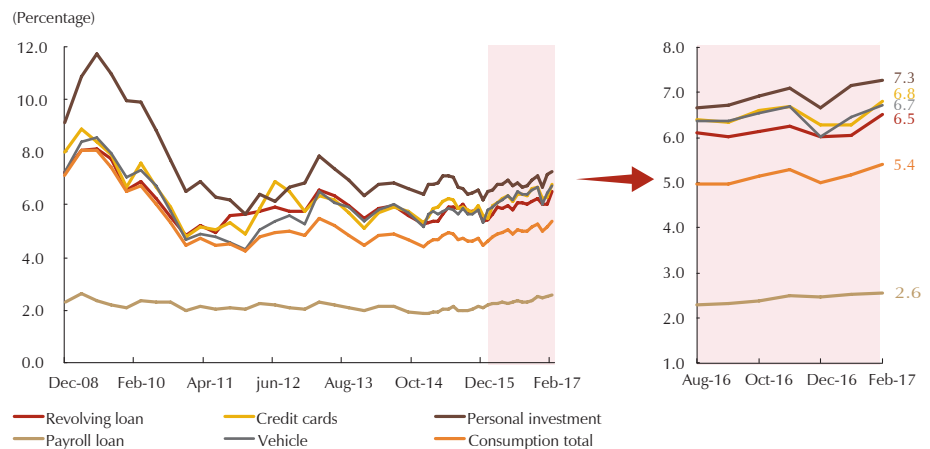
B.   Non-performing loan indicator by housing modality
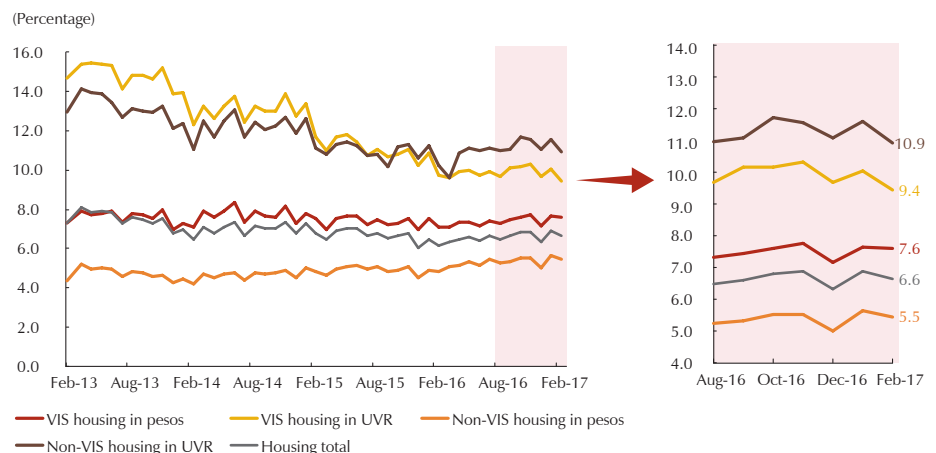
Sources: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República*.

Graph 25
Non-performing loan indicator by static pools

A. Non-performing loan indicator by static pools-personal investment

(Percentage)

Values shown: 1.6 1.3 1.6 1.9 2.5 1.8 2.7 2.2 1.4 1.1 1.2 1.1 1.2 1.5 1.5 1.3 1.3 1.2 1.2 1.0 1.2 1.5 1.7

Legend: ■ Contemporary — 6-month — 1 year — 2 years ···· Historical average

B. Non-performing loan indicator by static pools - vehicle loans

(Percentage)

Values shown: 1.0 1.5 1.2 1.2 1.2 1.2 1.4 1.3 1.0 0.9 0.8 0.9 1.1 1.2 1.3 1.2 1.1 1.3 1.2 1.5 1.5 1.8 1.8

Legend: ■ Contemporary — 6-month — 1 year — 2 years ···· Historical average

C. Non-performing loan indicator by static pools - revolving loans
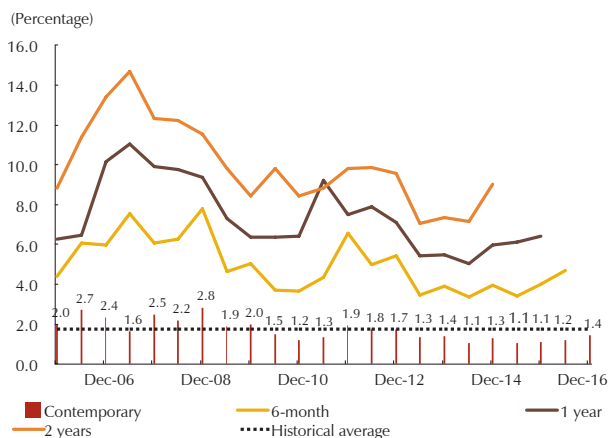
(Percentage)

Values shown: 2.0 2.7 2.4 1.6 2.5 2.2 2.8 1.9 2.0 1.5 1.2 1.3 1.9 1.8 1.7 1.3 1.4 1.1 1.3 1.1 1.1 1.2 1.4

Legend: ■ Contemporary — 6-month — 1 year — 2 years ···· Historical average

Sources: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República*.

loans granted between October and December of 2016 is the highest recorded since June 2009, and is located above the 1.6% historic average; this effect has been accompanied by a further deterioration of the static pools originated in mid-2016. Regarding vehicle loans, it can be seen that the non-performing loan indicator of pools started in the last quarter of 2016 is still above the historic average, highlighting a greater deterioration within the six months term of 2015 and June of 2016 pools, which is located in the historical peak. 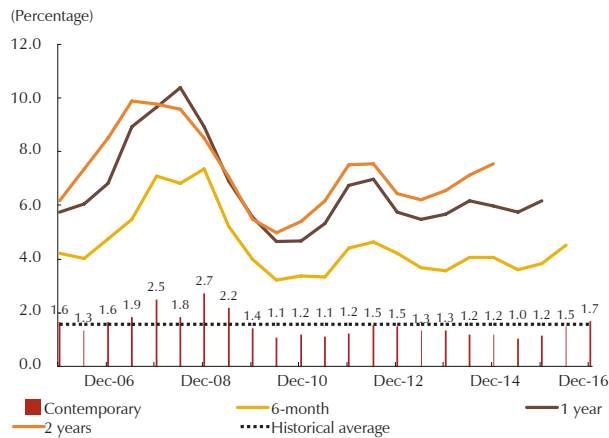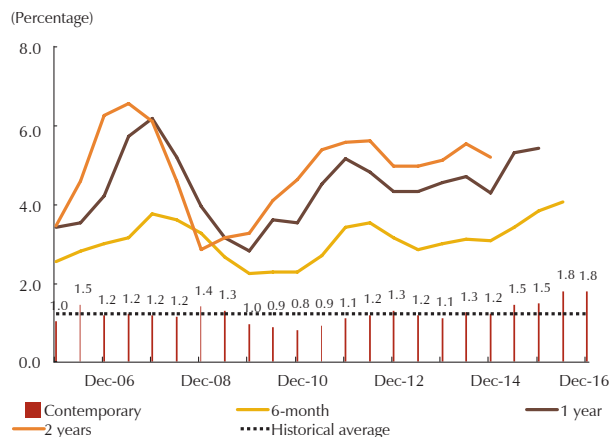Similarly, revolving loans exhibit a larger pool deterioration of the last period of 2016, as well as a decline in the quality of loans made since late 2014 (Graph 25, panels A, B and C).

On the other hand, the IPRC for consumption aggregate modality shows a slight increase, mainly explained by vehicle and other consumer portfolios behavior[23]. On the contrary, the credit card segment reversed the upward trend it had since 2014, and declined by 60 bp between August 2016 and February 2017 (Graph 26).

As for mortgage loan portfolio, although there is a relative stability in its analysis by static pools, the

Graph 26
Risk perception by rating indicator
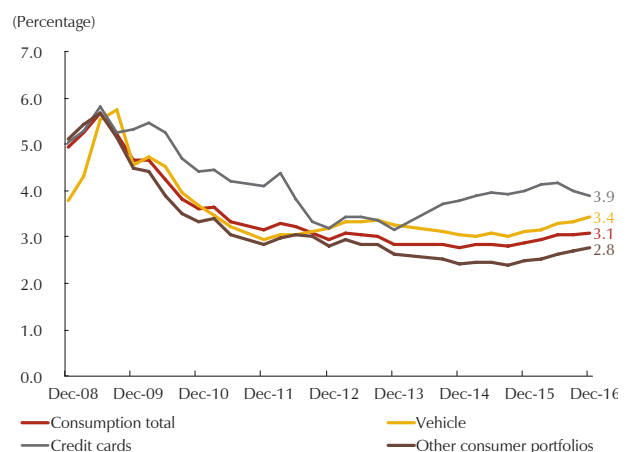
(Percentage)

Values shown: 3.9 3.4 3.1 2.8

Legend: — Consumption total — Vehicle — Credit cards — Other consumer portfolios

Sources: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República*.

23   Other consumption portfolios correspond to free investment, revolving and payroll loan modalities.
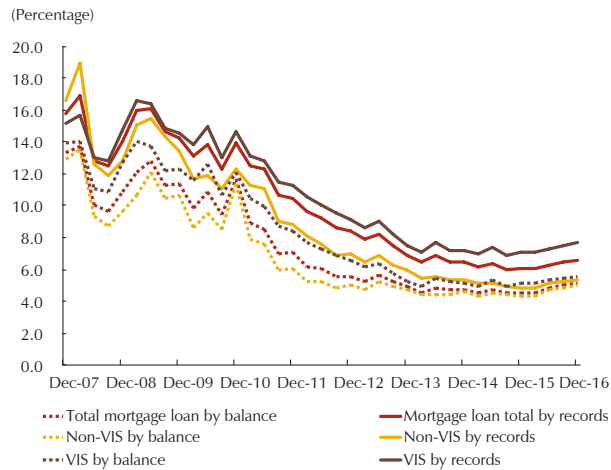
(Percentage)

likelihood of migrating towards a worse rating has exhibited a slight upward trend in the last year. This behavior has also been presented by modality, where the probability by balance has increased more for non-VIS loans, while the probability by records has increased more for VIS loans (Graph 27).

This deterioration in the household risk indicators could be associated with the fall in consumer confidence and intent of purchase of durable goods indexes, which are located at historic lows.

In addition, to assess the exposure of the entities that grant mortgage loans given a possible drop in the price of this asset, loan to value (LTV) is calculated[24]. Between June and December of 2016, LTV for non-VIS modality increased from 48.8% to 49.9%, mainly driven by second hand housing dynamics. On the contrary, LTV for VIS modality registered a decrease, from 59.5% to 58.0% in the same period. This indicator is still close to 20 pp below limits set by regulation.

The financial burden indicator, calculated at the aggregate level, remained relatively stable, while the one made with debtors' particular information showed a reduction as a result of the drop in monthly payments.

In addition to debt level, it is important to analyze household financial payment capability, based on balance information from financial intermediaries. In this regard, maturity at which debt and interest rate are agreed, are essential elements to be able to assess a household's financial burden level, defined as the ratio between interest payment and debt capital payment installment[25], over these agents disposable income. This way, household financial burden, calculated on the basis of information from the balance of credit institutions, the FNA, the CAC and employee funds, remained stable at 9.2%[26], where the interest payment ratio over disposable income was of 3.9% (Graph 28, panel A). By type of loan, the financial burden associated with consumer loans

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24 According to Decree 145 of 2000, modified by Decree 3760 of 2008, it is possible to finance up to 70% of the value of the property for housing other than social housing, while this percentage is of 80% for social housing.

25 This contribution to capital is calculated assuming that the loan portfolio is amortized at a constant maturity, which corresponds to the one registered in format 341 of the Office of the Financial Superintendent of Colombia in the case of credit institutions.

26 This level is still below the peak reached in 1998 (10.0%).

Graph 28
Household financial burden

A.   Financial burden components

(Percentage)

— Payment of interest and amortization with monetary correction/disposable income
— Payment of interest with monetary correction/disposable income
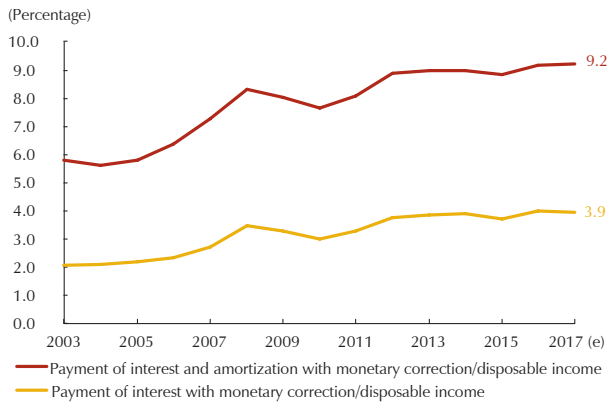
B.   Household financial burden by loan type (including amortizations)

(Percentage)

— Consumption   — Mortgage loan

(e): estimated.
MC: monetary correction.
Sources: Office of the Financial Superintendent of Colombia and Departamento Administrativo Nacional de Estadística (National Departament Administrative of Statistics); Calculations by *Banco de la República*.

remained around 7.4%, while that of mortgage loans remained at 1.8% (Graph 28, panel B).

To complement this analysis, another household financial burden indicator is featured[27], made on the basis of information of debtors registered at TransUnion credit bureau (formerly CIFIN)[28]. Between 2015 and 2016, the financial burden indicator declined from 22.2% to 19.4%[29], which is mainly explained by a decrease in monthly payments, in comparison with income dynamics[30] (Graph 29, panel A). Decrease in monthly payments may be related, partly, with the increase of the initial term in consumer and mortgage loans, which went from 4.5 and 13.1 years, to 4.6 and 13.4 years respectively. By income quintiles, the further reduction of the financial burden indicator was presented in the lowest quintile, which accounted for 4.7% of recorded debt (Graph 29, panel B). This drop in the financial burden indicator is also noted based on data from the household financial burden and financial l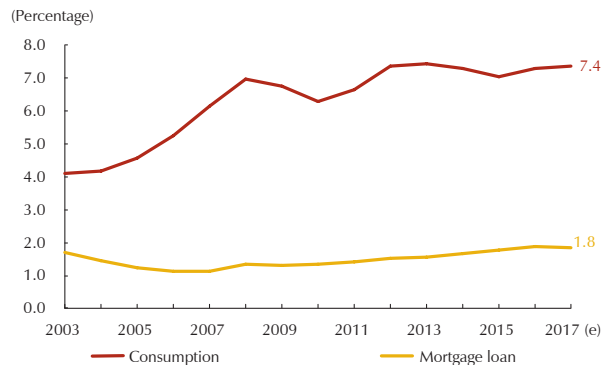iteracy survey (IEFIC), which went from 22.7% to 21.6% in the same period. In this case, quintiles 1 and 5 were the ones that showed the largest declines.

Finally, the evolution of deposits as an approximation of their savings is exposed. In January 2017, credit institutions balance[31] corresponding to households amounted to $ 79.7 trillion, where 59.8% are

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27   Financial burden indicator is calculated as the ratio between monthly payments and an estimate of the income from debtors registered at *TransUnion* credit bureau. For this calculation, only agents that have maintained the analyzed financial products during more than one year period, and who have not defaulted in their payments, refinancing or debt prepayments are considered.

28   *TransUnion* credit bureau has a database of the credit institutions debtors, in which the characteristics of all their obligations are recorded, including debt with entities of the solidarity, insurance and real sector, as well as information related to savings and current accounts of each debtor. Based on this information it is possible to construct a financial burden indicator for debtors with an estimated income.

29   This indicator differs from that presented in Graph 7, Panel A, given that the source of information is different. In this case, income taken for the calculation of the financial burden corresponds to households with debt, while the aggregate indicator takes the national disposable income of all households by data availability.

30   Financial burden indicator in Colombia is below the levels that are considered high (30%), and of vulnerability (40%) by the International Monetary Fund.

31   It is important to mention that this balance is underestimated, since it does not quantify the indirect holding of household deposits through other investment vehicles such as mutual funds, among others.

A.   Financial burden indicator

(Percentage)

2010	2011	2012	2013	2014	2015	2016
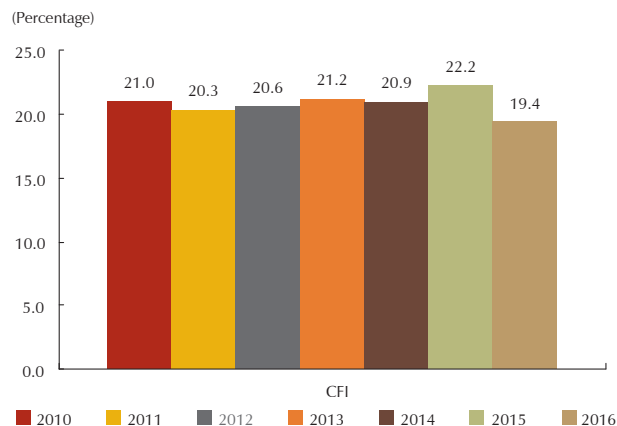
B.   Financial burden indicator by income quintiles

(Percentage)
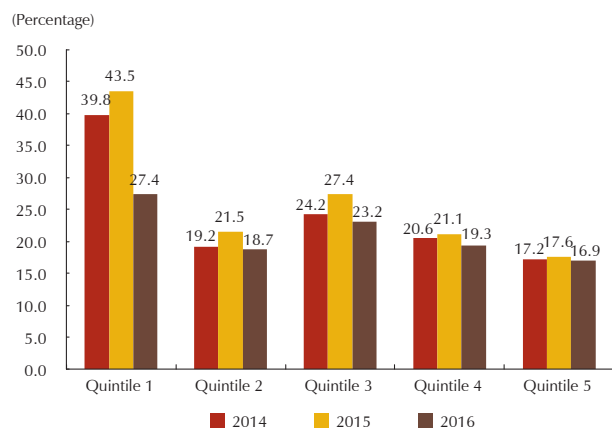
Source: TransUnion.

Graph 30
TES in Colombian pesos zero coupon curve (years to maturity)

(Percentage)
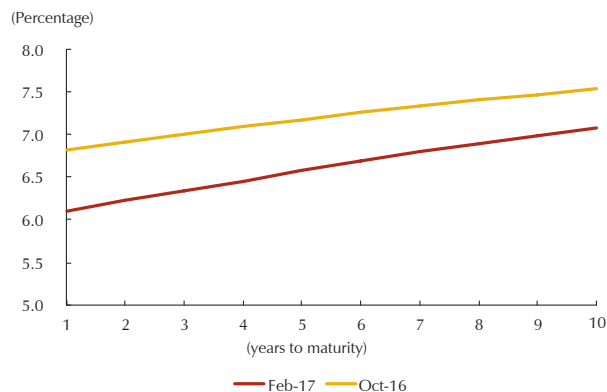
Source: Infovalmer; Calculations by *Banco de la República*.

savings accounts, 31.9% are term-deposits (CDT) and the remaining 8.3% are other saving sources[32]. Average annual real growth of these deposits continued slowing down, a trend that has been occurring since June 2015.

C.   MARKET RISK

The fixed income market presented valuations during the latter half of 2016 and so far in 2017. This has been driven by a greater global risk appetite, and by changes in monetary policy stance at the local level.

Public debt market experienced valuations in TES appraisals in all sections of the yield curve during the past six months. In particular, by February 28 of 2017 the points on the TES curve in Colombian pesos to one, five, and ten years, decreased by 71, 60 and 46 bp (Graph 30). The main determinant of the value of the short stretch was the drop in inflation during the analysis period and the consequent decline in *Banco de la República*'s intervention rate, a situation that impacted agents expectations in benchmark rate reduction pace (Graph 31).

On the other hand, valuations registered in medium and long sections are also explained because throughout 2016, and during 2017, foreign investors have increased their participation in public debt local market. This has been driven by the increase in global liquidity and in investors' risk appetite[33]. Even though all the sections of the curve had valuations, the impact of short-term determinants was greater than that of the medium and long-term ones, which generated steepening of the yield curve. Additionally, the private debt market recorded a performance

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32   Within these other savings sources are: current accounts, special savings accounts, real value savings certificates and trust funds and special accounts.

33   See for example *Global Financial Stability Report* of October 2016.

Graph 31
Graph 31
Implicit monetary policy rate expectation - Overnight Index
Swap Model (OIS)

(Percentage)
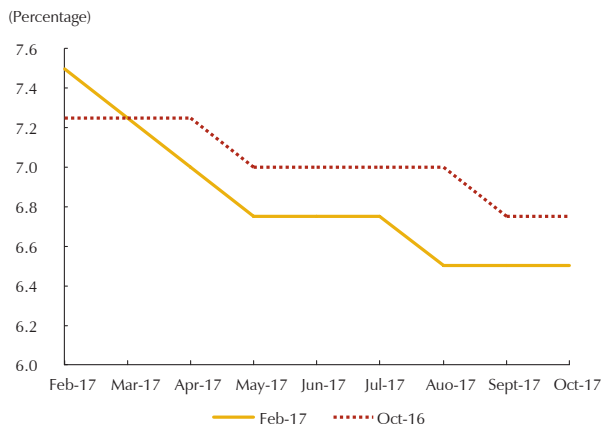
Source: Bloomberg; Calculations by *Banco de la República*.

Graph 32
Public and private debt markets behavior

(Level)

First main component TES-Colombian pesos
First main component BAAA2
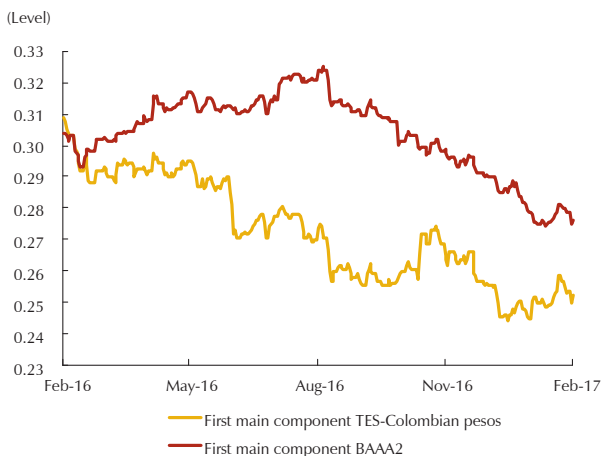
Source: Infovalmer; Calculations by *Banco de la República*.

Graph 33
COLCAP and Brent oil international price

(Level)   (Dollars)

COLCAP   Brent (right axis)
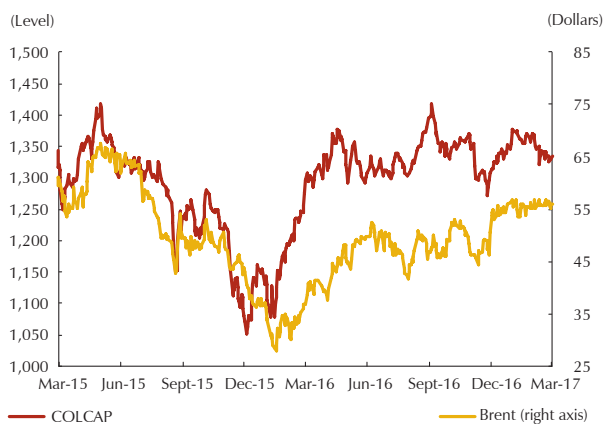
Source: Colombian Securities Exchange and Bloomberg.

similar to that of public debt in the last months of 2016 and so far in 2017, a situation contrary to the devaluation of the first half, as a result of increases in risk perception for these securities (Graph 32). Valuation determinants in the public debt market also affected private debt market, reason why in the last six months the correlation between the two markets was of 59.2%[34]. In particular, a significant inflow of foreign investors in this market has been noted according to foreigners' portfolio investment surveys from *Banco de la República*.

In the meantime, during the second half of 2016, the equity market presented a stable behavior due to the low volatility of the oil price.

Finally, valuation of the equity market, measured by the COLCAP index, shows a relative stability since April 2016, mainly associated with a similar behavior in the price of oil (Graph 33). This has occurred despite an increased demand by foreign investors in this market in the third and fourth quarters of 2016, as shown by *Banco de la República*'s Financial Markets Report. On the other hand, adverse situations in some specific equities have led to a drop in the COLCAP so far in 2017. Analysis of the volatility in fixed income markets in 2016 and so far in 2017, allows observing an increase in uncertainty in the public debt market with respect to what happened in 2015 (Graph 34). This behavior occurs in a context of increasing valuation of these securities and a more volatile external environment, due to geopolitical surprises and changes in the monetary policy stance of major world economies. This context also affected private debt market volatility, although to a lesser extent. On the contrary, local equity market reported a lower volatility on average during the last six months, in part associated with the low volatility in the price of oil.

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34   34 Correlation coefficient between the first main component of the TES curve in Colombian pesos, and the benchmark curve of the banking sector with AAA rating in simple fixed rate.

Graph 34
Fixed-income and equity markets conditional volatility in Colombia
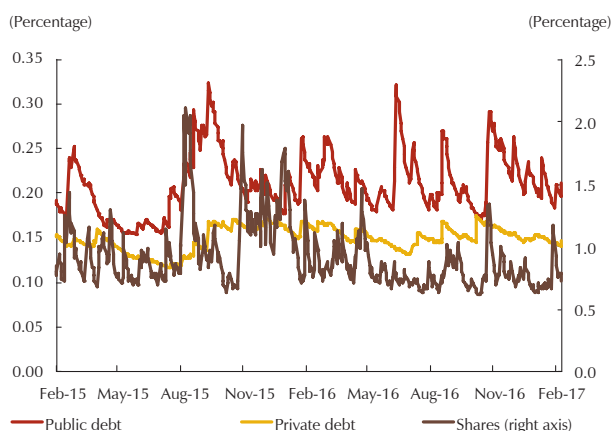
(Percentage)   (Percentage)

Source: Colombian Securities Exchange and Bloomber; Calculations by *Banco de la República*.

The main exposure to market risk by financial institutions is concentrated in the fixed-income market.

Exposure to fixed income and equity markets, measured as the investment in securities exposed to market risk[35], allows seeing that the greater exposure of the financial system is in fixed-income securities, where public debt represents the largest share. However, it is emphasized that insurance companies have a greater investment in private debt securities, for which reason the aggregate of non-banking financial institutions shows a greater exposure in this market. Regarding credit institutions, the highest participation is in the public debt market, being banks the type of entity with the greater investment in this kind of securities (Table 3).

Table 3
Balances of TES (in Colombian pesos and UVR), private debt securities and shares exposed to market risk from different financial entities (trillion Colombian pesos)

Entity Type	TES	Private Debt	Shares	Total
Credit Institutions	**34.05**	**6.90**	**5.50**	**46.46**
Commercial Banks	32.36	6.48	0.00	38.84
Financial corporations	1.67	0.32	5.50	7.49
Financing Companies	0.02	0.07	0.00	0.09
Financial cooperatives	0.00	0.03	0.00	0.03
Non-banking financial institutions (NBFI)	**7.41**	**19.56**	**5.54**	**32.52**
Pension funds proprietary position	0.21	0.53	0.04	0.77
Brokerage firms proprietary position	0.48	0.23	0.18	0.88
Trust Companies proprietary position	1.94	0.25	0.70	2.89
Insurance and capitalization companies	4.79	18.56	4.63	27.98
System in proprietary position	**41.47**	**26.46**	**11.04**	**78.98**
Third party position				
Brokerage firms third-party position	1.16	8.89	4.72	14.78
Trust Companies third-party position[a]	70.72	33.69	19.50	123.91
System	**215.71**	**179.14**	**73.03**	**467.88**

a/ Pension liabilities managed by trust companies are excluded.
Source: *Banco de la República*.

[35] This balance is at market prices and is calculated according to the guidelines of the basic accounting circular. For equity instruments of domestic issuers, balance in shares was analyzed, while for debt securities, tradables and available for sale were analyzed.

Despite the good performance exhibited by the markets, there have been increases in expectations of the Fed's rate so far in 2017, as mentioned in the macroeconomic environment section. If this increase takes place, the main risk in the fixed income and equity market is associated with the liquidation of foreign positions that could depreciate securities in the two markets. A greater magnitude liquidation would materialize in case the new government of the United States imposes tax benefits to investments in U.S. assets.

D. LIQUIDITY RISK AND INTEREST RATE OF THE BANKING LEDGER

1. Liquidity risk

This section analyzes liquidity risk in the financial system, considering that its materialization represents high costs for intermediaries, as well as the loss of confidence from the public and its counterparts. To that end, entities' funding structure and evolution and their costs are assessed. Then, the availability of liquid resources by institutions is assessed, and finally deposits risk concentration is reviewed.

The funding gap for credit institutions is at positive levels, although it exhibited reductions at the beginning of 2017.

Credit institutions funding gap, understood as the difference between loan portfolio and deposits, continues at positive levels, by reaching a value of $ 46.9 trillion in February of 2017. Despite the fact that since the first quarter of 2014 the gap was presenting a growing trend, it began showing a slowdown since the first period of 2016. In the course of 2017 this measure has been reduced, particularly due to the lower growth of the loan portfolio in relation to deposits (Graph 35, panel A).

By definition, decreases in the funding gap should be reflected in increases in assets other than loan portfolio, or in less funding by sources different to demand or term deposits[36]. Between August 2016 and February of 2017, credit institutions funding gap decreased by $ 4.6 trillion, which in general was reflected in lower financial obligations, liability position in the money market and other liabilities, as well as in increase in investments.

---

36   This is deducted from the gap funding definition and the identity the balance must meet: $FG = P - D \equiv OL + K - OA$; where GF is the funding gap, P the loan portfolio level, D the balance of deposits, OL the other liabilities, K the equity, and OA are the other assets.

By entity size, it is observed that funding gap for large banks[37] presented a dynamic similar to that recorded for credit institutions total, by reaching a value of $ 35.6 trillion in February 2017; however, the decreasing trend of the gap since December 2016 is highlighted. On the other hand, medium-sized banks gap continued exhibiting a growing trend, reaching $ 5.8 trillion, while the small banks one remains stable around $ 5.2 trillion (Graph 35, panels B, C, and D).

Graph 35
Funding gap and its growth

A.   Credit institution

(Trillion Colombian pesos)

B.   Funding gap

(Trillion Colombian pesos)

C.   Medium banks

(Trillion Colombian pesos)
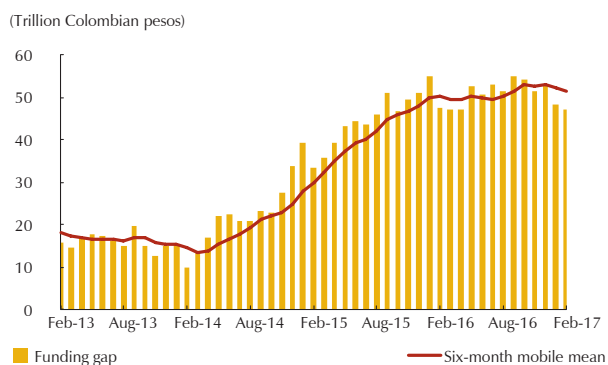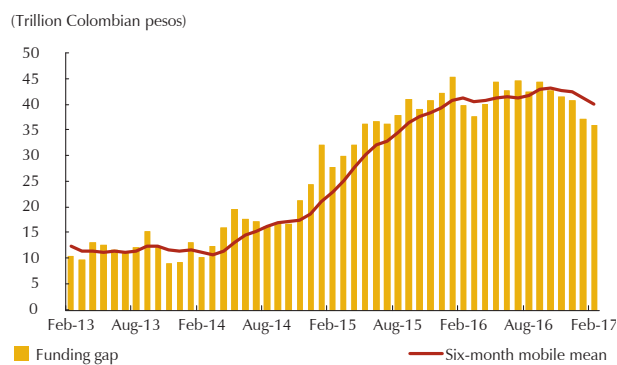
D.   Small banks
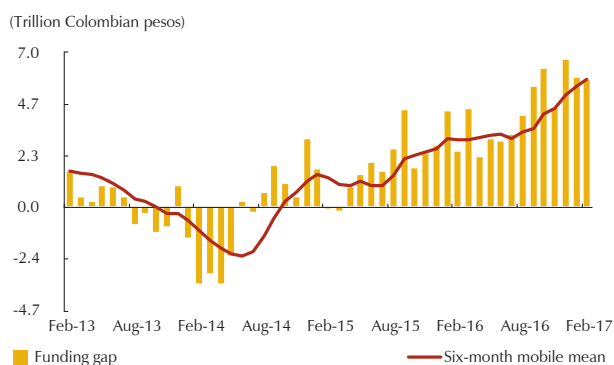
(Trillion Colombian pesos)
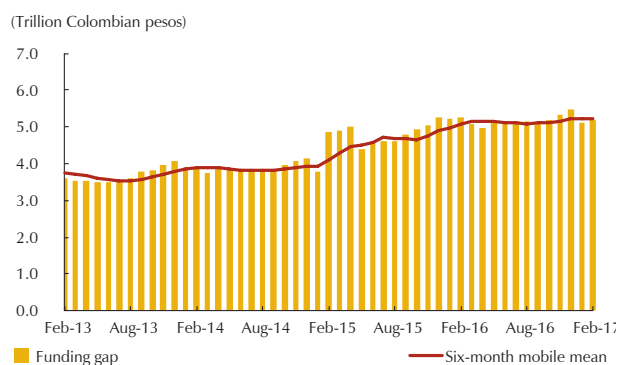
Note: Considered deposits are: savings accounts, current accounts, term deposit certificates, real value savings certificates and special savings accounts.
Source: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República*.

Funding of credit institutions primarily decreased due to demand deposits behavior, while term deposits continue to contribute positively…

To analyze credit institutions funding sources evolution, Graph 36 shows liabilities and equity dynamics. It is noted that credit institutions obligations reached an annual real growth rate of -2.4% in February 2017, mostly

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37   Classification is made considering the loan portfolio size, where large banks are those that have a balance greater than $ 25.0 trillion, the medium ones between $ 7.0 trillion and $ 25.0 trillion, and the small size ones a balance of less than $ 7.0 trillion. Notwithstanding the above, this report includes an entity which formerly was a commercial financing corporation, and which from October 2016 was acquired by a bank, in the large banks classification.

A.   Credit institutions

(Percentage)

B.   Large banks

(Percentage)

C.   Mid-size banks

(Percentage)

D.   Small banks

(Percentage)
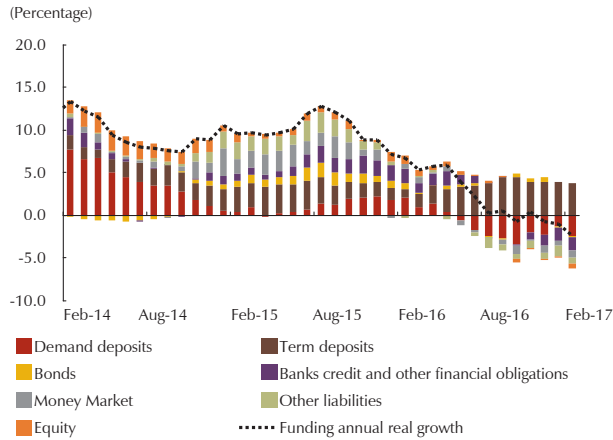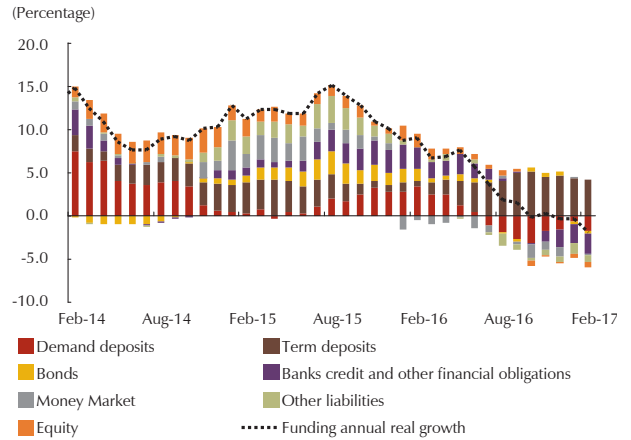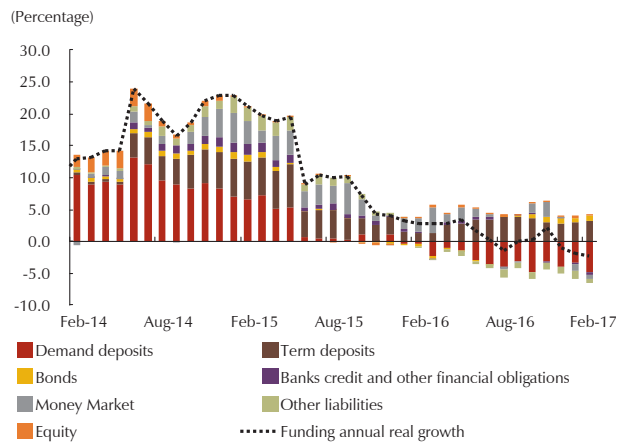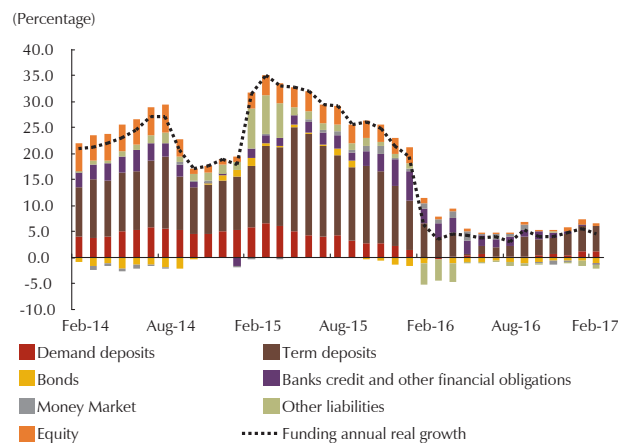
Note: other liabilities correspond to: outstanding bankers acceptances and derivatives, capital contributions, banks and correspondents, Bonds optionally convertible into shares (BOCAS), Bonds mandatory convertible into shares (BOCEAS), Savings term deposit certificate (CDAT), accounts payable, electronic deposits, affiliate establishments, other deposits and demands 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*.

explained by the negative contribution of funding through demand deposits, financial obligations, and money market. On the other hand, the term deposit certificates (CDT) are the only funding source that positively contributed to this growth (3.8%; Graph 36, panel A).

… this was explained by funding behavior for large and medium-sized banks, while for small ones this remained relatively stable.

Taking entity size into account[38], it is observed that large and medium-sized banks recorded lower real growth rates in February 2017, compared with six

_____

38   Banks classification according to their size follows the criteria given for funding gap.

months ago (-1.9% and 4.6% in August 2016, compared to -2.3% and -1.4% on the analysis date). This is explained for big banks by the reduced contribution of financial obligations, demand deposits and bonds. On the other hand, for medium-sized banks, growth decrease responded in particular to demand deposits behavior. Small banks funding dynamics remained stable, although CDT's larger contribution is highlighted (Graph 36, panels B, C and D).

Funding through new CDT issuances has decreased for maturities longer than one year, although in terms of balance is the most representative for credit institutions.

Graph 37
Credit institutions CDT evolution

A.   New CDT issuances by maturity
        (six-month average)

(Million Colombian pesos)

- Lower than six months
- Between six and twelve months
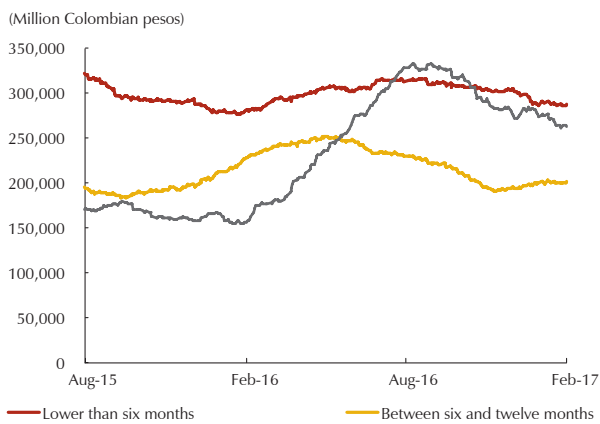
B.   CDT balance by issuance maturity
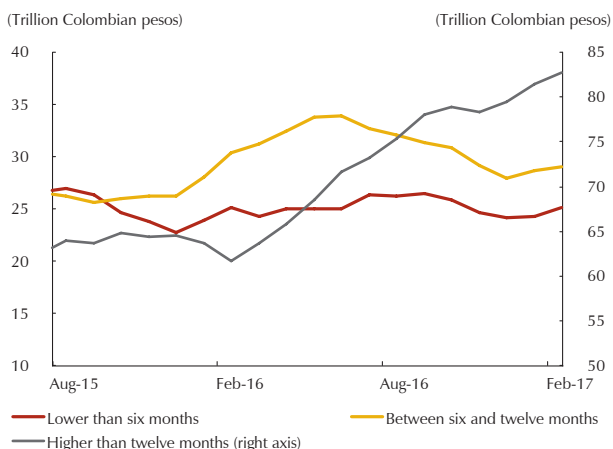
(Trillion Colombian pesos)   (Trillion Colombian pesos)

- Lower than six months
- Between six and twelve months
- Higher than twelve months (right axis)

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

In February 2017, new average issuances of CDT presented heterogeneous dynamics for various maturities. In the case of term deposits with maturities longer than twelve months, there has been a reduction in the flow from these issuances, compared with six months ago. On the other hand, lower than six months maturities issuances dynamics have remained stable, while that of between six and twelve months has picked up since the end of 2016 (Graph 37, panel A).

Even though new long-term issuances were reduced, these keep showing the highest figure in institution's balance sheet. In the case of CDT with maturities shorter than or equal to one year, balance dynamics has responded, in part, to what has been observed for new issuances (Graph 37, panel B).

On the other hand, funding cost exhibited a decrease compared with six months ago.

Rates of CDT and money market deposits[39] reached an average value of 7.4% and 7.1% respectively in February 2017, which showed a reduction compared to six months ago (8.0% and 7.3%, in that order). On the other hand, savings deposits rate has remained stable since mid-2016, reaching 3.9% at the time of analysis. In general, the decline in deposits rates was related to monetary policy intervention rate behavior (Graph 38).

39   The money market deposit rates correspond to weighted averages by the amount of the credit institutions, in simultaneous operations with public debt securities. These operations correspond to those made in both the Colombian Electronic Market (MEC) and the Electronic Trading System (SEN).

Graph 38
Deposits interest rates and money market operations for
credit institutions (20-day moving average)

(Percentage)

Three month BRI[a/]   Policy rate   CDT
Savings Deposits   Money market deposit rate
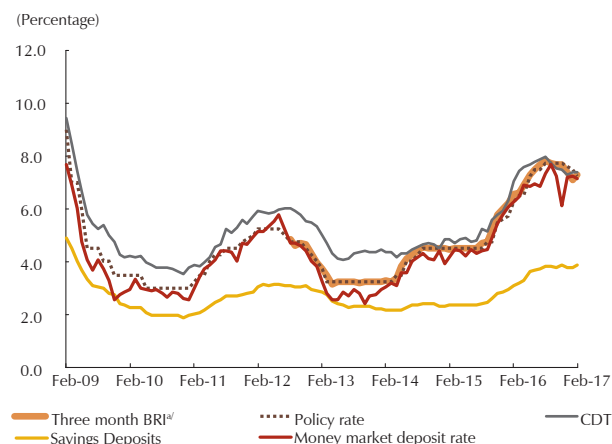
a/ Three-month BRI data are available from 2012.
Source: Office of the Financial Superintendent of Colombia, *Banco de la República*; Calcu-
lations by *Banco de la República*.

Graph 39
Balance, limit and available collateral for repo operations
with *Banco de la República*

(Trillion Colombian pesos)

Repos balance   Available securities[a/]   Limit[b/]
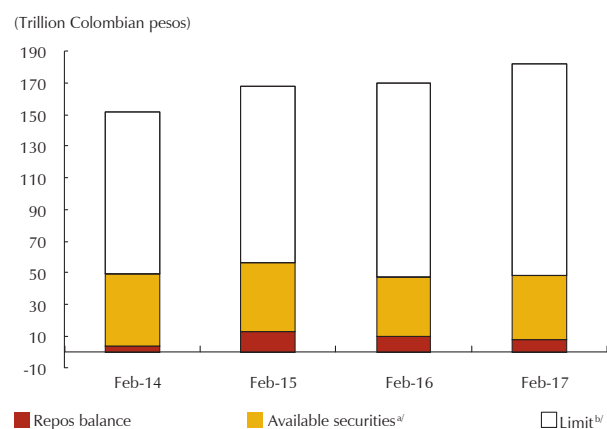
a/ Include investments at fair value with changes in results, investments at fair value with
changes in the ORI, investments at amortized cost, only mandatory investment, transfer of
rights with *Banco de la República*, securities received from operations from simultaneous,
intraday and repos balance.
b/ Corresponds to 35.0% of liabilities subject to reserve requirements.
Source: Office of the Financial Superintendent of Colombia and *Banco de la República*.

*Entities have sufficient quota and guarantees to
demand liquidity through repo operations with
Banco de la República, and their ability to carry
out these operations increased.*

In February 2017 entities capacity for resorting to
resources at *Banco de la República*, defined as the
ratio between net available titles and repos balance,
increased in relation to the past two years and was at
4.1 times[40], [41]. The above this responded to a decrease
in the amount of repos, along with the increase in
the value of available securities[42]. In this way, with a
possible reduction in funding, intermediaries would
have sufficient guarantees for resorting to resources
of *Banco de la República* (Graph 39).

*Except for some situational and seasonal events,
credit institutions and stock brokerage firms did
not show significant changes on their short-term
liquidity.*

In February 2017, credit institutions show a
Liquidity coverage ratio (LCR) above the regulatory
minimum, which had diverse fluctuations.
Regarding commercial financing companies, these
recorded an increase in their short-term liquidity
due to the merger of an entity that had relatively
low levels of the indicator. On the other hand, at
the end of 2016 financial cooperatives recorded a
decrease in their LCR, while the stock brokerage
firms recorded an increase. These dynamics
responded to seasonal behaviors typical of each
entity, for which reason at the beginning of 2017
this trend was reversed (Graph 40).

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40   Includes credit institutions that can access repo operations with *Banco de la República*.

41   Net available securities refer to the difference between the balance of securities available for use
as collateral in repo operations with *Banco de la República*, and the balance of the repos that entities
currently have with the Bank.

42   This result contrasts with the one presented in the section *Current situation of the financial sys-
tem* of this report, in which a decrease in credit institutions investment is noted. This is due to the fact
that in the present analysis monthly averages of available securities are used, which sometimes differs
with results with data with end of the month closing date.

A.   Credit institutions 30 day LCR

(Percentage)
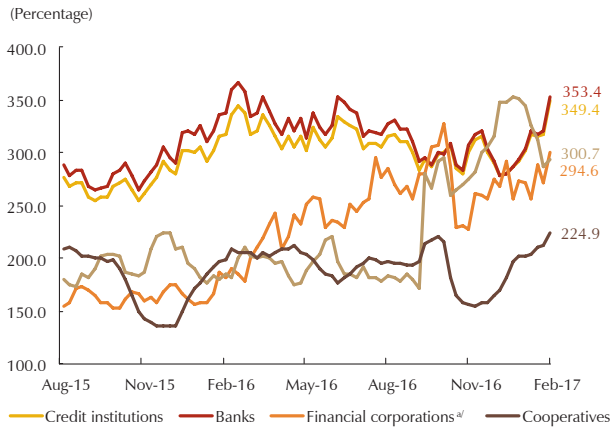
B.   Stock brokerage firms' one and seven days LCR

(Percentage)
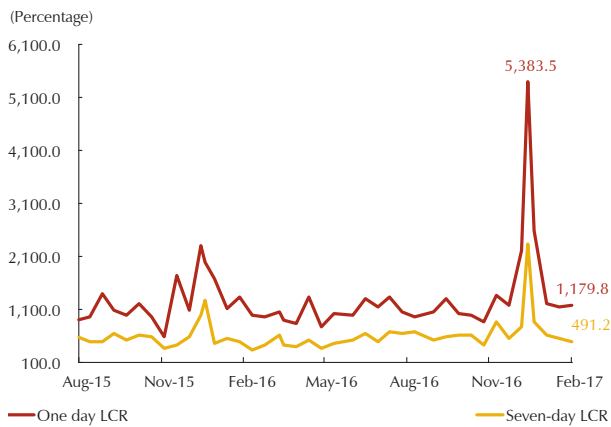
a/ the increase in the indicator of commercial financing companies in October 2016 was due to the merger between leasing Bancolombia and Bancolombia. This commercial financing corporation had low 7 day LCR levels, and was the largest of this kind of intermediary, thus the merger generated an increase in the commercial financing corporations indicator.
Source: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República*.

When assessing liquidity by entity, it is noted that all maintain adequate LCR levels, although 16% of credit institutions showed an indicator close to the regulatory minimum, relative to their volatility[43]. It is highlighted that this group of entities is only composed of financial corporations and commercial financing companies.

In general, banks' demand deposits are stable, although when analyzing by type of client, it is observed that that those coming from other credit institutions are volatile.

When analyzing banks funding volatility, it can be seen that demand deposits from other credit institutions continue being the most susceptible to withdrawal, followed by the non-banking financial institutions ones (Table 4). Real sector deposits, which are the most representative in credit institutions liabilities (18.7%), have a low volatility. For their part, most volatile demand deposits have the lowest credit institutions liabilities share. This deposits structure suggests that credit institutions have stable funding sources[44].

Banks have a level of liquid assets that would allow them to face withdrawal of their major customers.

Finally, in terms of concentration, a hedging indicator for banks given a withdrawal of their main depositors was calculated. This is defined as the ratio between liquid assets and demand deposits of the ten and twenty major clients. As it can be seen in Table 5, banks could face a withdrawal of the totality of these deposits, being large banks the ones with less coverage. In addition, it is noted that the latter decreased their indicator between August 2016 and February of 2017, in contrast with small and medium-sized banks. Participation of deposits of major customers on

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43   It is considered that an entity has a close to the regulatory minimum LCR level, relative to its volatility, if its observed indicator is located at less than one standard deviation of 100%.

44   For a more detailed analysis of funding sources stability, see Box 2: *Identification of stable and non-stable* funding sources of this *Report*.

Table 4
Counterparty demand deposits stability

| Counterparty type | Negative percentage variation average | | Variation coefficient[a/] | | Liabilities share (Percentage) |
	Aug-16	Feb-17	Aug-16	Feb-17	Feb-17
Individuals	(1.83)	(1.93)	0.25	0.25	11.4
Real sector	(2.65)	(2.60)	0.24	0.24	18.7
Credit institutions	(8.90)	(8.94)	0.37	0.37	1.0
Non-banking financial institutions (proprietary and third-party)	(5.76)	(5.54)	0.32	0.32	4.8
Public sector	(4.07)	(4.36)	0.17	0.17	6.8

a/ The variation coefficient is defined as the ratio between standard deviation and the mean.
Source: Office of the Financial Superintendent of Colombia; Calculations by Banco de la República.

Table 5
Hedging indicator of demand deposits of the main clients and its liability share (banks)

| Date | Clients | Large | | Medium | | Small | |
| | | Hedging Indicator | Share | Hedging Indicator | Share | Hedging Indicator | Share |
		(Percentaje)					
Feb-16	10 main	228.1	6.3	399.7	4.4	522.4	2.3
	20 main	158.1	9.0	270.4	6.5	385.4	3.3
Ago-16	10 main	276.9	5.0	469.0	3.7	505.7	2.3
	20 main	193.9	7.1	311.5	5.5	361.6	3.3
Feb-17	10 main	251.7	5.9	515.4	3.5	568.2	2.3
	main	181.8	8.2	331.2	5.4	411.3	3.2

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

the liabilities remains low, and did not present considerable variations during the same period.

2. Banking ledger interest rate risk

This section analyzes the interest rate structure of credit institutions balance, as well as its exposure to banking ledger's interest rate risk[45]. The measurement of this risk is aimed to estimate how changes in interest rates of assets and liabilities affect net interest income.

Credit institutions have more than half of assets agreed at a fixed rate, while in the liability this proportion is less than 50%.

_____

45   This risk has two dimensions: the first one is the one that is discussed in the market risk section and refers to the risk of devaluation of the assets of the treasury ledger to interest rates variations; the second, which is discussed in this section, corresponds to studying how changes in interest rates alter entities net interest income. For this, banking ledger data is used.

A.   Assets

57.3%
23.3%
4.9%
8.1%
2.1%
3.0%
1.2%

■ DTF   ■ UVR   ■ RBI
■ PCI   ■ Libor   ■ Other
■ Fixed rate

B.   Liabilities

30.7%
11.0%
4.9%
0.2%
6.1%
8.7%
2.4%
0.4%
35.6%

■ DTF   ■ UVR   ■ RBI
■ PCI   ■ Libor   ■ Other
■ Other Fixed rate   ■ PLiabilities Corporations ■ Individuals b/
                                 and official entities a/
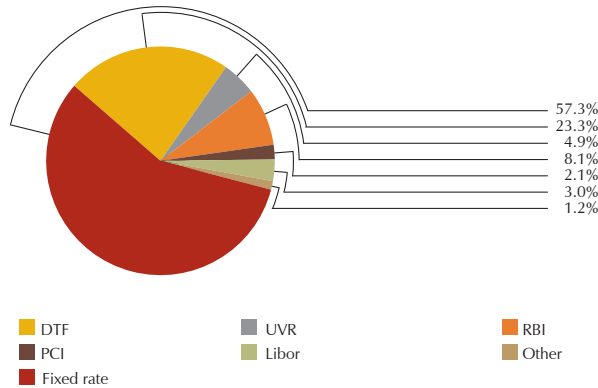
a/ Corresponds to savings and current accounts of corporations and official entities.
b/ Corresponds to savings and current accounts of individuals.
Source: Office of the Financial Superintendent of Colombia; Calculations by *Banco de la República.*

By February 2017, it is noted that 57.3% of assets are agreed at a fixed rate, while those denominated in a variable-rate accounted for 42.7%. Within these, those indexed to the DTF are the most important with a participation of 54.7%, followed by those pegged to the BRI and the UVR, with a proportion of 19.1% and 11.4% respectively. On the other hand, the assets in foreign currency indexed to the LIBOR accounted for 7.1% of variable rate total assets (Graph 41, panel A).

On the liabilities side, 35.6% is agreed at a fixed rate. However, within current and savings accounts, individuals could be regarded as fixed rate liabilities, given that they present a low elasticity to variations in the benchmark interest rate. In this way, the total proportion of liabilities at a fixed rate could be approached to 46.6%. Regarding those agreed at a variable rate, the ones with the greatest share are tied to the CPI (8.7%), followed by those indexed to the BRI and the DTF, with a ratio of 6.1% and 4.9% respectively (Graph 41, panel B).

A decrease of instruments tied to the DTF and an increase in those attached to the RBI was observed both in assets as in liabilities.

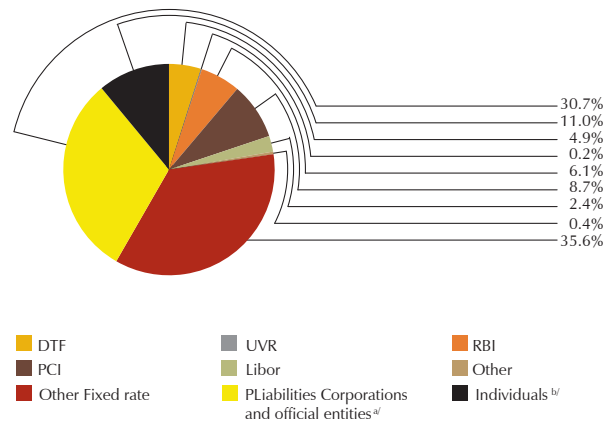A continuing decline in the proportion of assets and liabilities indexed to the DTF was observed between February 2015 and the same month of 2017. While in assets this share fell from 35.0% to 23.3%, it did so in liabilities from 8.5% to 4.9%. On the other hand, the participation of assets tied to the BRI passed from 2.5% to 8.2%, while the proportion of liabilities contracted at this rate increased from 5.4% to 6.1% over the same period (Graph 42, panels A and B).

There was a decrease in exposure to banking ledger interest rate risk between August 2016 and February 2017…

For measuring banking ledger interest rate exposure risk, the WATM gap indicator was calculated, which is defined as the difference between assets and liabilities sensitive to changes in interest rates. When this indicator takes a negative value, it implies that an increase in the lending and deposit rates in the same magnitude would generate a reduction in net interest income. This

A.   Assets

(Percentage)

B.   Liabilities

(Percentage)

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

Graph 43
WATM gap
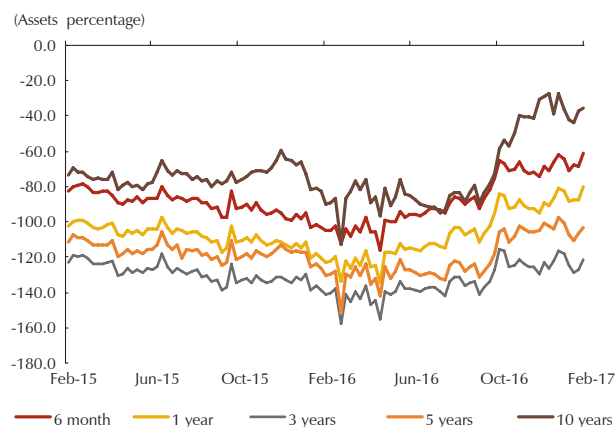
(Assets percentage)

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

interest rate risk measure depends primarily on two factors: 1) The proportion of assets and liabilities contracted at a variable rate, and 2) the term of fixed rate assets and liabilities[46].

The WATM gap was calculated for different time horizons between February 2015 and the same month in 2017. In general, it is observed that for all analyzed periods the indicator has a negative value, which indicates that credit institutions would see a reduction in their net interest earnings given increases of the same magnitude in lending and deposit rates[47]. However, between August 2016 and February 2017 there is a closure in the gap for all the analyzed time periods which indicates that entities have reduced their exposure to this risk[48] (Graph 43).

…mainly explained by the increase in the participation of longer-term funding sources and of individuals' savings accounts.

Reduction in the WATM gap is mainly explained by the increase in the liabilities share of CDT with maturities longer than one year. While in August 2016 these instruments accounted for 18.2%, in

46   For more detail on the calculation of the *WATM gap* see box: "Interest rate risk of credit institutions banking ledger in Colombia" of the *Financial Stability Report* of September 2015.

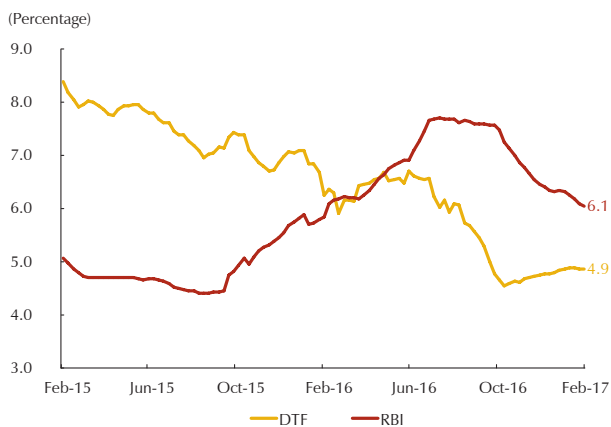47   It should be noted that the estimate at the aggregate level of this indicator for credit institutions reflects the average exposure levels of these entities to the risk discussed in this section. Nonetheless, there may be significant differences at the individual level, while some entities recorded a *negative WATM gap*, others have an indicator above zero, so that their net interest income would increase given rises of the same magnitude in lending and deposits interest rates.

48   When analyzing the behavior of the *WATM gap* by horizon of analysis, it shows that both for the short-term (6 months) as for the longest one (10 years), the indicator registers values close to zero. This is explained mainly for two reasons: 1) In the 6 month horizon, the value of the liabilities sensitive to changes in interest rates is the lowest since their calculation does not include all fixed-rate liabilities with maturities higher than 6 months, and 2) for a 10 year period, the value assets sensitive to interest rates is higher because since it includes, in addition to all fixed rate assets that are considered within the lower maturities, the balance of those with maturities of more than 5 years, as for example much of the housing loan portfolio, which causes the gap to be closer to zero.

February 2017 this value was of 19.7% (see Graph 11). In addition, another factor that contributed to the decline of banking ledger interest rate risk was the increase in the proportion of savings accounts held by individuals, whose participation in the total balance of savings accounts went from 26.3% to 27.4% in the same period. Therefore, the increase of the share of CDT with maturities longer than a year decreases the speed at which fixed-rate liabilities is repriced, while the increase in the proportion of savings accounts of individuals decreases the average sensitivity of liabilities to changes in interest rates.

Daisy Johana Pacheco
Ana Maria Yaruro[*]

Analysis of households' financial situation is one of the topics that are addressed in the Financial Stability Report (REF), given financial entities exposure to this sector and the impact that a shock on these agents could have on financial stability. Debt levels and risk indicators presented in chapter II of the Financial Stability Report are made based on aggregate information from the balance sheets of institutions offering consumer credit and mortgage loans. This information is complemented with the results from the Households financial burden and financial literacy survey (IEFIC), which has been applied in Bogotá by the National Administrative Department of Statistics (DANE) since 2010. Based on this survey, the Special Report on households' financial burden is published since 2012, where indicators on the financial vulnerabilities of these agents are presented, among which the financial burden, debt at risk, and relationship between debt and wealth stand out.

This box presents two significant improvements to this analysis carried out in the last year, which are intended to have more precise information on Colombian households' financial vulnerabilities, as well as to approach the sensitivity tests presented in research work from other countries.

1.   Extension of coverage

In order to increase the national representativeness of the IEFIC, *Banco de la República* and DANE studied the possibility of extending the coverage of the survey to other cities in the country in order to have a more representative sample of Colombian households' financial situation. In this way, it was decided that starting this year, Medellín and Cali were incorporated into the survey, by which financial information of the cities with the highest participation within the total loan portfolio would be obtained. In fact, to December 2016 these three cities accounted for 68.2% of credit institutions loan portfolio (Bogotá: 43.5%, Medellín: 16.7% and Cali: 8.0%).

In addition, given the importance of the payment systems for the functions carried out by *Banco de la República*, some questions regarding the access and use of means of payment such as debit and credit cards, transfers between accounts and mobile payments, are included into the questionnaire among others. This will allow the study of consumers' payment habits, and to monitor the evolution in the use of cash and electronic payments in Colombia.

2.   Sensitivity test

Following the work carried out by the International Monetary Fund within the 2012 Colombian Financial Sector Assessment Program, as well as the documents published by officials of the central banks of Uruguay, Chile and Canada, a sensitivity test was carried out in order to evaluate the effect of a shock to labor income on the financial burden and households' debt at risk level. Results were presented within the Households Financial Burden Special Report of September of 2016. This test complements the one developed in previous reports, where the sensitivity analysis was performed assuming that all households would lost 20% of their income. The following is a summary.

In the first place, a probability of unemployment model for the heads of household was estimated considering some sociodemographic characteristics, such as their educational level, age, gender and marital status. These variables were taken from the Great Integrated Household Survey (GEIH), after combining it with IEFIC data, which was possible, given that both databases have the same identifier per person[1].

Then, heads of households whose estimated unemployment probability was higher than the average of the sample were identified, for which a loss of 60% of their income was assumed. From this shock, households financial burden indicator, defined as the ratio between financial payments (capital + interest) and income, was calculated again. Finally, the change in debt at risk indicator (before and after the shock), which is defined as the debt ratio held by households with a greater than

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1   The IEFIC sample is obtained from a filter question applied within the GEIH; this way, within the IEFIC there information of those surveyed by the GEIH who expressed having at least one financial product and being over 18 years of age.

40% household financial burden, was analyzed. Results show that a shock of this type would increase this indicator from 44.1% to 61.6% in 2016 (Graph B1.1).

Graph B1.1
Debt at risk

(Percentage)

	Before the shock	After the shock
2014	38.6	54.7
2015	39.0	58.1
2016	44.1	61.6
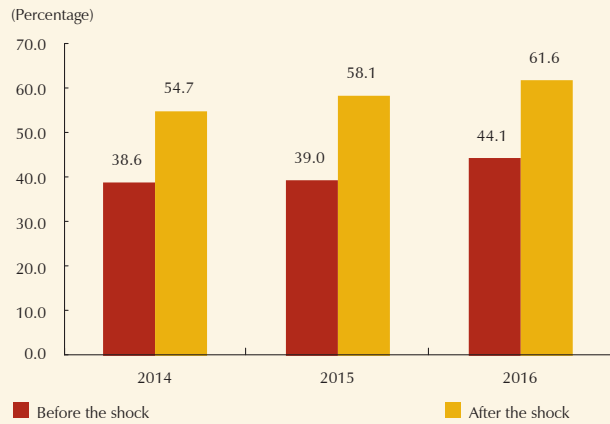
Source: Households financial burden and financial literacy survey; self-made calculations.

IDENTIFICATION OF STABLE AND NON-STABLE FUNDING SOURCES

Álvaro Fernando Aguirre
Oscar Fernando Jaulín
Jorge Luis Hurtado
María Fernanda Meneses[*]

1. Introduction

Funding of assets that are not very liquid with liquid liabilities generates a funding liquidity risk to credit institutions. This risk consists in the possible inability of the bank to comply with its obligations, due to the fact that it has assets that are not easily liquidated, such as the loan portfolio. To mitigate this risk, banking institutions seek stable funding sources that enable them to renew their liabilities on a regular basis. However, the distinction between stable and non-stable sources is not clear in literature, as mentioned in Box 1 of the Financial Stability Report of March 2016.

The purpose of this box is to offer an approach for such classification in Colombia, taking into account qualitative factors such as the counterparty of each funding source, and quantitative, like the observed volatility of the main funding sources. It is important to mention that, although volatility makes it possible to quantify the stability of liabilities, it does not identify which factors determine the dynamics of sources, since their stability may depend on both decisions of counterparties and preferences that institutions have on the structure of their liabilities.

2.   Methodology

In order to measure the volatility of each series, fifteen items of balance sheet's liabilities and equity were identified from 2009 to 2016 for credit institutions in Colombia with a monthly frequency[1]. A set of volatility estimators was calculated for the monthly growth of

each of these items: 1) The variation coefficient (VC), defined as the ratio between the standard deviation and the average; 2) the mean absolute deviation (MAD), calculated as the average of the absolute value of deviations from the mean; 3) median absolute deviation (MEAD), defined as the median of deviations from the series median; and 4) inter-quartile range (IR), which corresponds to the difference between the third and first quartile of the distributions[2].

3. Results and conclusions

Table B2.1 shows the funding sources, sorted according to the volatility estimated by each of the mentioned measures. The value of each slot corresponds to the position of each item in ascending order, being 1 the least volatile. In this document, funding sources are classified as not very volatile if they have a hierarchy of less than 10 in at least three of the four considered indicators.

It is noted that items listed as stable by the literature (demand deposits from individuals, term deposits, bonds and equity) exhibit the lowest volatility levels, proving the hypothesis that these must be classified as stable funding sources. In addition to these items, loans with rediscount institutions show a low volatility, despite being loans granted by other financial entities, which in the literature are usually recognized as volatile. In Colombia, these obligations do not involve exposure to funding liquidity risk, because in these kind of operations credit institutions only act as intermediaries between the second-tier bank and the debtor; therefore, the dynamics of this funding source responds to the demand for loans that are financed by this type of obligations.

In contrast, other items, such as demand deposits of the financial and non-financial public sectors, short positions in the money market, and obligations with other banking institutions register a higher volatility, which indicates less stability.

Repos with *Banco de la República* deserve a special analysis. On the one hand, quantitative results indicate high volatility, since their use depends on the liquidity needs of the economy. Nevertheless, the particular characteristics of the counterparty, which induce stability,

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[1]   The sample size was defined based on the availability of the 459 form: "Degree of concentration of deposits and bonds," provided by the Financial Superintendent of Colombia.

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[2]   Measures were scaled as a ratio of the average and median to make them comparable between series.

Table R2.1
Order of funding sources by volatility

Funding source	VC	MAD	MEAD	IR
Equity	1	1	1	1
Loans with rediscount institutions	3	3	4	3
Bonds	2	2	5	5
CDT-Financial sector	6	5	3	4
CDT-Individuals	10	8	2	2
CDT- Real sector	5	6	6	6
Demand deposits of Individuals	4	4	8	9
Demand deposits of the real sector	7	9	7	7
Repos with Banco de la República	8	7	12	12
Short positions in the money market[a]	11	11	10	10
Demand deposits of the financial sector	9	10	13	13
Demand deposits of non-financial public sector	14	14	9	8
Loans with Financial entities[b]	12	12	11	11
Other liabilities[c]	13	13	14	14
CDT-Non-financial public sector	15	15	15	15

a/ Does not include repos with Banco de la República
b/ Does not include loans with rediscount institutions
c/ Circulating acceptances and derivatives, capital contributions, banks and correspondents, accounts payable, electronic deposits, affiliate establishments, other deposits and demands with and without amortization cost, labor obligations, provisions and collection services.
Sources: Financial Superintendent of Colombia and Banco de la República; calculations by Banco de la República.

should be consider, given that if the entity meets the conditions to perform operations with *Banco de la República*, it will be able to access the Central Bank's funding. In this sense, Basel considers that operations with central banks backed by guarantees are continuously renewed and, thus, constitute a source that is always available. Therefore, in this document this type of funding will be classified as stable.

From the above considerations, in Table B2.2, analyzed funding sources are classified between stable and non-stable.

This classification may be used as reference for the definition of "available stable funding," which is part of the calculation of the Net Stable funding Ratio indicator proposed by Basel.

Table R2.2
Classification of funding sources according to the obtained results

Funding source	
Stable funding sources	Non-stable funding sources
Equity	Loans, financial entities[a]
CDT, financial sector	Short positions in the money market[b]
CDT, real sector	Demand deposits, non-financial public sector
Demand deposits, individuals	Demand deposits, financial sector
CDT, individuals	Other liabilities[c]
Demand deposits, real sector	CDT, non-financial public sector
Repos with Banco de la República	
Bonds	
Loans with rediscount entities	

a/ Does not include loans with rediscount institutions
b/ Does not include repos with Banco de la República.
c/ Circulating acceptances and derivatives, capital contributions, banks and correspondents, accounts payable, electronic deposits, affiliate establishments, other deposits and demands with and without amortization cost, labor obligations, provisions and collection services.
Sources: Financial Superintendent of Colombia and Banco de la República; calculations by Banco de la República.

Given the previous classification, panel A of Graph B2.1 shows funding composition by source type, and panel B presents funding growth and the contribution to this growth of each source type. It is noted that in the middle of 2013 and 2015 there was an increase in the contribution of non-stable sources in credit institutions' funding. During 2013, this phenomenon was explained by the larger contribution of demand deposits of the non-financial public sector and of loans with financial institutions without rediscount operations. During 2015, the latter source also prompted the dynamics of non-stable funding along with the other liabilities.

Nowadays, there is a slowdown in growth of funding sources due to the fall of financing using non-stable resources, while the stable ones continue to contribute positively to funding growth, despite its slowdown.

A.   Funding composition

(Trillion Colombian pesos)

■ Stable   ■ Non-stable

B.   Funding growth and contribution
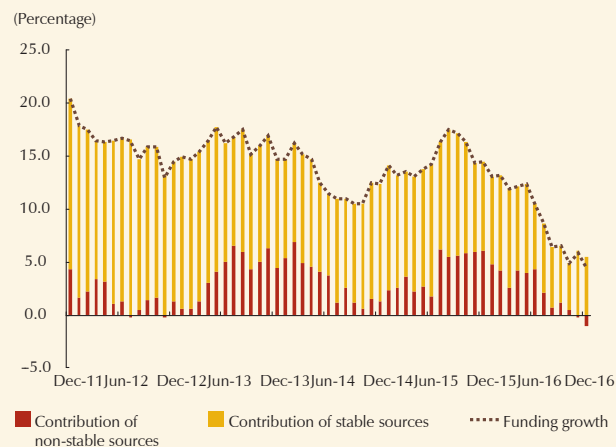
(Percentage)

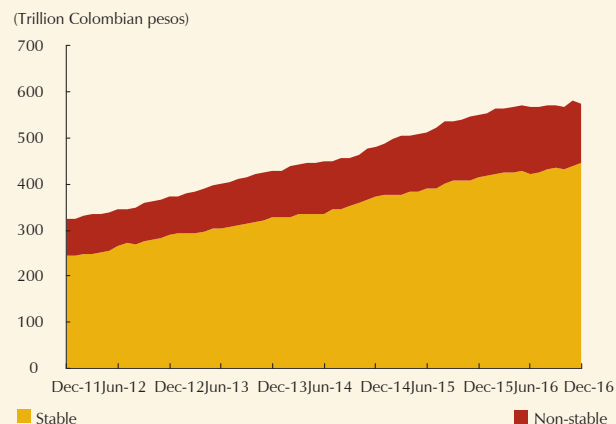■ Contribution of   ■ Contribution of stable sources   ····· Funding growth
  non-stable sources

Sources: Financial Superintendent of Colombia and *Banco de la República*; calculations by *Banco de la República*

III.   STRESS TESTING[49]

This section describes the structure and the results of the biannual sensitivity test applied by *Banco de la República* to credit institutions. This test, known in international literature as stress test, seeks to measure credit institutions resilience in the face of a potentially adverse scenario. Results suggest that aggregate capital ratios of the system would not show values lower than the prudential limits on the considered scenario.

The stress test is a quantitative analysis that evaluates resilience of credit institutions against an adverse and unlikely hypothetical macroeconomic scenario.

This chapter features a quantitative exercise that seeks to evaluate credit institutions capability for facing a hypothetically adverse scenario. This kind of tests, known in international literature as stress tests, are routine among a broad group of central banks, and seek to calculate the impact the materialization of a set of risks would have on credit institutions. In this edition of the Financial Stability Report, the exercise calculates the impact of a hypothetical scenario, which foresees a reduction of investment, a drop in consumer confidence and foreign demand, and an increase in risk perception from international investors in a two-year horizon from late 2016. This scenario is motivated by the vulnerabilities that this report has identified for the financial system in the current macroeconomic context. In this sense, it corresponds to the assessment of a particular set of shocks, which excludes potential alternative risk sources that the financial system could face.

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49   This test was jointly made between the Financial Stability and Macroeconomic Models departments of *Banco de la República*.

The adverse scenario considered in the exercise has been intentionally designed for reflecting an extreme situation for the Colombian economy, since it incorporates various shocks that would occur simultaneously. In this sense, test results do not constitute a forecast or a probabilistic consideration on the future evolution of the Colombian economy. Instead, results should be interpreted as a quantitative evaluation of the resilience of institutions to an extreme scenario, based on their current financial conditions and under restrictive assumptions. In addition, the exercise assumes that the economic authorities respond to the macroeconomic stress, but there is no policy response to the deterioration of the financial statements of institutions, nor preventive measures in the monitoring of their risk management, from which the impact of the adverse scenario would presumably be smaller.

The usefulness of the test lies in offering an estimate of potential losses that would be observed if the extreme scenario were to materialize. Finally, the test helps to shed light on the possible transmission channels through which the identified vulnerabilities could end up affecting financial stability.

Results indicate that the impact of the hypothetical scenario on aggregated capital ratio would have a moderate magnitude.

Test results suggest a moderate effect of the adverse scenario on aggregate capital ratio indicators, both total as core tier 1, remaining at levels exceeding regulatory limits. At the same time, certain negative effects on loan portfolio volume, their quality and business profitability of credit institutions would be observed. This highlights the need to continue with the careful monitoring, both of debtors and entities financial situation, as of changing conditions of the macroeconomic context.

This chapter is organized in five sections. The first one presents the characteristics of the considered extreme macroeconomic scenario throughout the test. The second section discusses the set of impacts that this scenario would have on credit institutions risks panorama. The third properly describes the test by the characterization of entities behavior in the extreme scenario, and the channels through which the scenario would impact their financial soundness. Test results are featured in the fourth section, while the last one presents some concluding remarks.

1.   Scenario: Macroeconomic paths

The paths of the main variables in the scenario are determined by a macroeconomic model that incorporates shocks on investment, the risk premium, foreign demand, and consumer confidence for the horizon of analysis.
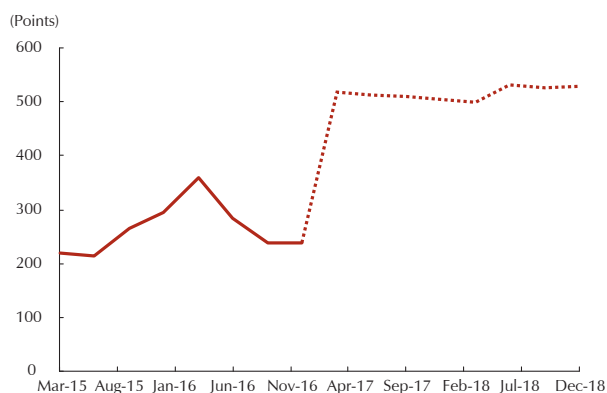
The aggregated variables paths of the Colombian economy that make up the hypothetical scenario are determined by a stochastic general dynamic equilibrium model (DSGE), on which a set of macroeconomic shocks are incorporated. This model aims to capture some key features of a small and open economy such as the Colombian one. Among these, the model includes nominal rigidities, monetary policy response in form of a Taylor rule, the possibility of access to financing in international markets, and the decisive role of the foreign demand for locally produced goods and services. Trajectories described by the model are consistent in macroeconomic terms.

The exercise seeks to capture the effects of an adverse context in civil works investment, consumer confidence, foreign demand and risk perception of international investors during a two-year horizon since the end of 2016. For this, a set of shocks are simultaneously introduced to the model equilibrium. In the first place, a reduction of investment associated with infrastructure projects; in second place, a sudden increase in the risk premium (emerging markets bonds indicator: EMBI); in the third place, a reduction of foreign demand for goods and services of the Colombian economy, and finally, an abrupt drop in domestic consumer confidence. The previous combination of shocks could be caused, for example, by the exacerbation of the risk associated with the development of infrastructure projects, along with the reduction of trade flows in a context of growing protectionism and uncertainty at the global level. The size and intensity of these shocks has been estimated with the objective of replicating some of the features observed in a period of global economic turbulence (specifically, the unleash of the international financial crisis after the collapse of Lehman Brothers in September 2008) and considering the projections on investment flows in fourth generation road infrastructure projects in Colombia.

By incorporating these shocks on the general equilibrium model estimated for the Colombian economy, aggregate variables paths in the hypothetical scenario are obtained. Graph 44 presents the trajectory of the risk premium and investment from March 2015 and for the comprised analysis horizon. In this, a sudden increase in the risk premium took place, while investment would continue with negative growth rates during the first six quarters of the hypothetical scenario.

Graph 44
Macroeconomic variables paths

A.   Risk premium (EMBI Colombia)

B.   Annual growth of the investment
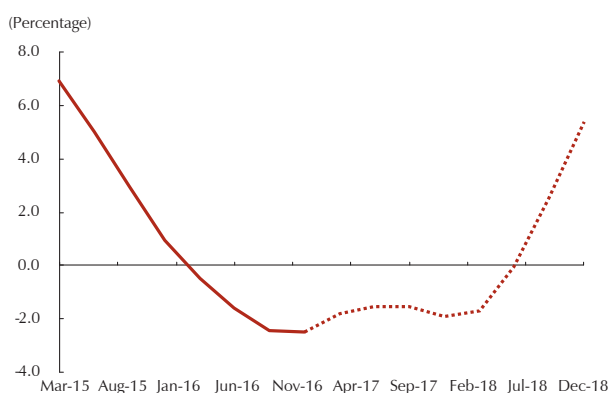
Sources: *Banco de la República* and Bloomberg (until December 2016); Calculations by *Banco de la República* (March 2017 to December 2018).

According to the model, reduction in consumer confidence, investment and foreign demand raised in the hypothetical scenario, would trigger a decrease in the rate of growth of the economy and an increase in the unemployment rate[50]. In this context, the monetary authority (which follows a Taylor rule) would progressively reduce the intervention interest rate as a response to the macroeconomic deterioration. However, this mitigating response is limited due to the increase in the rate of the natural interest of the economy, that happens because of the increase in the risk premium.

2.   Impact of the adverse scenario on the credit institution's risks outlook

The hypothetically adverse scenario described in the previous section would involve the simultaneous materialization of various risks. In a first stage, without taking into account the credit institutions response to the scenario, macroeconomic deterioration would trigger a drop in loan portfolio quality (credit risk) and volatility in public debt securities market (market risk). Credit institutions endogenous response to the scenario, would unleash, in turn, in a second stage which considers the materialization of additional risks that will be analyzed in section 3.

a.   Credit risk

The scenario would involve the materialization of various risks. Regarding credit risk, the dynamics of the loan portfolio quality indicator is estimated for each loan portfolio type using the macroeconomic paths and loan portfolio quality rolling of vulnerable firms is assumed.

In respect of credit risk, the adverse hypothetical scenario contains two elements which would lead to the simultaneous materialization of different risk sources. On the one hand, the drop in infrastructure investment would mean difficulties for those firms belonging to sectors related to that activity. On the other hand, macroeconomic deterioration would have the natural consequence of increasing default rates in the economy as a whole. The materialization of these two risk sources is simultaneously incorporated to the hypothetical scenario of the test.

It is assumed that the reduction of infrastructure investment would result in the gradual deterioration of the loan portfolio quality of those firms

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50   The general equilibrium model used in this test does not include the unemployment rate as an endogenous variable. Therefore, the path of this variable in the hypothetical scenario was estimated using a satellite model of determination of the unemployment rate as a function of growth rate of different sectors of the Colombian economy. This model was jointly developed with the Labor Market Group of the Economic Studies Division at *Banco de la República*.

belonging to the sectors of civil engineering works and specialized activities for civil works, companies that as of December 2016 accounted for 7.7% of the commercial loan portfolio. Specifically, the test poses a gradual reduction (or rolling), in an exogenous way,[51] of two levels in loan portfolio rating of these firms during the horizon of analysis.

On the other hand, credit risk materialization caused by macroeconomic deterioration comprises two elements. In the first place, the test assumes that the adverse scenario would trigger a gradual rolling of two levels in the rating of the set of firms identified as vulnerable. This group is comprised of firms belonging to the sectors identified in section II.B of this report (mining, electricity, transportation, and restaurants and hotels) and companies intervened by the Office of the Superintendent of Corporations of Colombia, Office of the Superintendent of Public Utilities, or the Office of the Superintendent of Solidarity. These companies participate with 16.0% and 3.4% of the commercial loan portfolio, respectively.

Secondly, the test uses a vector autoregressive model (VAR) for estimating the paths for the quality of commercial, consumer, mortgage, and microcredit loan portfolios. Specifically, a VAR model that includes the loan portfolio quality indicator for each of credit type, the growth of the Colombian economy, the respective lending interest rate, the new housing price index calculated by *Banco de la República*, industrial production and retail commercial activity indexes, the percentage change in the consumer price index and the unemployment rate. In general, the estimation of the model indicates that quality risk indicators dynamics is mainly due to the growth of the economy and its respective lending interest rate. The lending interest rates trajectories used for projecting the quality risk indicators in the adverse scenario during the horizon of analysis, are obtained using stressed paths for the spread between the lending interest rates and the policy rate[52].

Graph 45 shows the evolution of the quality risk indicator by credit type that would be observed in the stress scenario. Of course, the global economic slowdown, combined with the high spreads that are posed in the hypothetical scenario cause a sustained increase in quality indicators during the analysis horizon. For the case of consumer and mortgage loans, quality indicators dynamics shows a particularly sharp deterioration as a result of the increase in the unemployment rate in the adverse scenario.

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51   The amount of the loan portfolio whose rating is lowered, is determined in proportion to the drop of the GDP growth rate in each quarter.

52   Specifically, for each credit type the test assumes a spread equal to the largest two-year average spread over history.

Graph 45
Quality risk indicator's paths by credit type

A. Commercial

(Percentage)

B. Consumer

(Percentage)

C. Mortgage

(Percentage)

D. Microcredit

(Percentage)
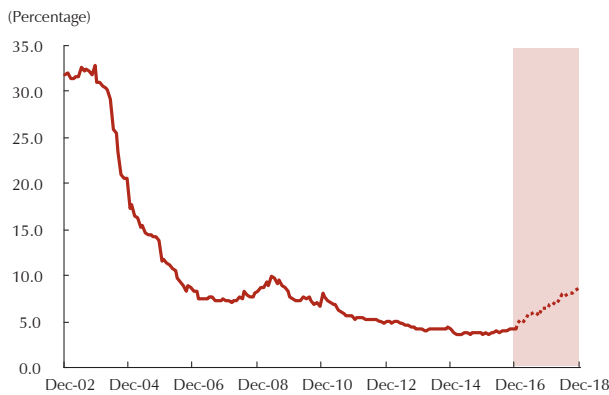
Source: (until December 2016) (March 2017 to June 2018).

b. *Market Risk*

Regarding market risk, the value reduction of debt securities and shares due to the exit of foreign investors, which would occur as a result of the confidence shock is assumed.

Regarding market risk, the exercise assumes that the hypothetical increase in the perception of risk of international investors on the adverse scenario would result in sudden and permanent exit of foreign holders from the local public debt market, with the consequent effects on the valuation of the investment portfolio of the credit institutions. Specifically, the test poses a displacement of the zero-coupon curve of TES, in which the increase in rates is calculated assuming the liquidation of the participation of foreign investors in each one of the vertices of the curve. For this, the following exponential inverse demand function is estimated:

$$b_j = e^{-\alpha_j (Q_j)} \tag{1}$$

$$\Delta Q_j = \sum_i s_{ij} \tag{2}$$

Where b_j is the price of a zero-coupon bond with a maturity j, Q_j is the stock of TES that is offered for sale in the market at maturity j and parameter α_j is defined as the sensitivity of b_j to a change in Q_j. Given that s_{ij} represents the sotck of TES with maturity j that the foreign investor i decide to sell, ΔQ_j would correspond to the additional amount of securities to be offered on the market due to the sale of these investors. According to equation (1), the percentage change in the price and the interest rate of the security with maturity j, as a result of the liquidation of the portfolio held by foreigners, would be determined by:

$$\Delta\ln(b_j) = -\alpha_j \Delta Q_j \tag{3}$$

$$\Delta r_j = \frac{-\Delta\ln(b_j)}{\frac{t}{365}} \tag{4}$$

To calculate (3) and (4), only ΔQ_j and α_j are needed for each maturity j. For the former, aggregate flows of TES held by foreign investors, with closing date of February 24, 2017 is determined, making use of the coupon rate for each security. Following the methodology proposed by RiskMetrics[53], these flows are distributed to its corresponding vertex. On the other hand, calibration of α_j parameters was made posing an assumption on the maximum fall in the price of securities if the total flow (both held by local and foreign investors) assigned to the vertex j (W_j) were liquidated[54]. Specifically, it is assumed that the largest drop in price is equal to the maximum haircut (h_j) applied to liquid securities for repo operations with *Banco de la República* (16.1%), multiplied by the ratio between the minimum daily return of the vertex j (min r_j) and the minimum daily return of TES total supply[55] (min r_0). This way, the parameter for each vertex corresponds to:

$$\alpha_j = \left(\frac{\min r_j}{\min r_o}\right) \times \frac{h_t}{W_.} \tag{5}$$

For private debt, an approximation of the value reduction of these securities is made using the movements of the TES yield curve. Specifically, the test considers the relationship between the returns on government and private debt securities using the TES zero-coupon curve and the BAAAFS curve respectively. Finally, and in a way in line with stress in the financial markets,

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53   For more information see *JP Morgan* (1996) Technical Document, Fourth Edition, December.

54   See Cabrera et. al (2012).

55   TES supply return is calculated as the weighted average of the returns of each vertex, where such weighting corresponds to the observed on, February 24, 2017.

a value drop of 19.2% is assumed for equity securities[56]. These shocks happen instantly and simultaneously in the first period of the analysis horizon (first quarter of 2017).

3. Simulation of financial statements of credit institutions

The impact of the described macroeconomic scenario on financial system's risks would have different transmission mechanisms toward entities financial statements. These mechanisms are the result of a set of assumptions over the investment decisions of the institutions, the dynamics, and the distribution of deposits of the system and the evolution of interest rates, financial obligations maturities and liquidity requirements. Also, it is assumed that, in the face of exceeding solvency or liquidity regulatory limits, entities would cease paying their obligations.

An important assumption to highlight is that there is no additional reaction from economic and regulatory authorities against the deterioration of the financial soundness of institutions other than the reduction in monetary policy interest rate. Below are the main components for simulating credit institutions financial statements.

a. Reinvestment rule

Given the shocks mentioned, credit institutions' financial statements are simulated in accordance with the reinvestment rule that determines the allocation of available resources and the endogenous dynamics of institutions during the test.

For each period of analysis, the test implies that institutions allocate their available resources on loan portfolio placement or cash (risk free asset). Financial institutions take this decision endogenously, given a specific objective regarding solvency and liquidity.

The starting point of the rule is the amount of available resources (d_t) with which each entity counts on, at the beginning of the period, given by the following expression:

$$d_t = a_t + \Delta PSE_t + u_{t-1} \qquad (6)$$

Where a_t corresponds to amortizations of the loan portfolio, ΔPSE_t the change in liabilities subject to reserve requirements (*PSE*), and u_{t-1} to the

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56   Maximum value at risk (VaR) at 95% with a one day horizon of the COLCAP index, using the available history of indicator's tradable days. This value was registered in October 16, 2008.

flow of reinvested profits at the closing of the previous period. In this way, the institution determines the amount of loans to grant (p_t), in accordance with the following expressions:

$$p_t = \text{máx}\{0, \text{mín}\,[d_t, \overline{D}_{ST,t}, \overline{D}_{SB,t}, \overline{D}_{L,t}]\} \tag{7}$$

$$\overline{D}_{ST,t} = \frac{PT_t}{\lambda_{ST}} - \left(\frac{100}{9}\,RM_t + APNR_t\right) \tag{8.}$$

$$\overline{D}_{SB,t} = \frac{PBO_t}{\lambda_{SB}} - \left(\frac{100}{9}\,RM_t + APNR_t\right) \tag{9.}$$

$$\overline{D}_{L,t} = AL_t + d_t - RL_t\,\lambda_L \tag{10}$$

where $\overline{D}_{ST}$ and $\overline{D}_{SB}$ are the maximum amounts of granted loans that total capital and common equity tier target levels would allow; *PT* and *PBO* are the total regulatory capital and common equity tier 1; *RM* is market risk; APNR corresponds to risk level weighted assets, and λ_{ST} and λ_{SB} are total capital and common equity tier target levels[57]. On the other hand, $\overline{D}_L$ corresponds to the maximum amounts of granted loans that the target liquidity indicator would allow, where *AL* is the balance of liquid assets, *RL* is the liquidity net requirements of the entity, and λ_L represents the liquidity indicator target level[58].

The expression (7) indicates that the amount of loan portfolio granted by each institution is determined by what its available resources allow, total capital and common equity tier 1[59], and the liquidity indicator[60], in the event that the entity does not reach the target levels of these indicators at the beginning of the period. Otherwise, the expression indicates that the institution cannot grant loan portfolio nor contracting its loans portfolio in order to increase its capital adequacy ratio (that is, does not sell nor writes-off the loan portfolio). The remnant of available resources, after granting loans, is invested in risk-free liquid assets (i_t), according to the following expression:

$$i_t = d_t - p_t \tag{11}$$

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[57] In this test λ_{st} corresponds to minimum regulatory total capital ratio (9%) plus a 50 basis points prudential margin, while λ_{SB} equals to minimum common equity tier 1 ratio(4.5%) plus a 25 basis points prudential margin.

[58] In this case, λ_L corresponds to minimum regulatory liquidity indicator (100%) plus a 30 percentage points prudential margin.

[59] Note that expressions (8) and (9) correspond to the maximum loan portfolio increase and, therefore, of the $APNR_t$ which would make that total capital and the common equity tier 1 ratios were exactly equal to their respective target level.

[60] Considering that the remnant of available resources after granting the loan portfolio is invested in risk-free liquid assets, which increase liquid assets balance (AL_t), expression (10) represents the amount of granted loans such that the balance of liquid assets is equal to the target level of liquidity requirements.

b.   *Risks materialization*

In accordance with the performance of individual entities, funding, liquidity, interest rate and contagion risks could materialize.

As noted, the adverse macroeconomic scenario involves the exogenous materialization of market risk and credit risk. On the other hand, credit institutions response to the adverse scenario would cause the endogenous materialization of funding, liquidity, interest rate and contagion risks.

Regarding the risk of funding, it is assumed that the aggregated PSE of the system are kept constant and its distribution among the EC depends on the type of entity and certain performance indicators. In particular, as loan portfolio delinquency increases and the total capital ratio and earnings decreases, institutions would exhibit lower growth rates of the PSE.

Regarding liquidity risk, minimum requirements dynamics depends on contractual and non-contractual income and expenses flows. The increase in the loan portfolio default, due to credit risk materialization, reduces effective earnings by loan portfolio. In addition, cash income of an entity is reduced when another credit institution, acting as a counterpart in interbank loans, simultaneous or derivatives operations, defaults on its obligations. On the other hand, cash outflows are assumed as constant in the horizon of the test.

In terms of interest rate risk, the interest rate trend of policy associated with the macroeconomic scenario generates changes in interest rates of the economy, and therefore, in institutions lending and deposit interest rates. Changes in the interest rate of the various assets and liabilities during the horizon of the test depend, largely, on whether positions are contracted at a fixed rate, or if they are tied to some interest rate of the market. In the case of assets and liabilities positions at a fixed rate, it is assumed that, at the time of renewal, the interest rate presents a dynamic related to the interest policy rate of the general equilibrium model. For those lending positions at a variable rate, the test sets the price in accordance with the elasticity of the different benchmark rates to the BRI[61], while for variable-rate deposit positions these elasticities are calculated differentially for different classes of depositor (for example, deposits of institutional agents versus deposits of individuals).

In addition, a reduction in credit institutions liabilities average maturity is assumed along the horizon of analysis. In particular, institutions would only be able to renew liabilities to a term no less than or equal to three months, reflecting increasing difficulties to obtain long-term financing in an adverse

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61   The BRI overnight rate is taken as a proxy of the policy interest rate.

context, while it is assumed that the new loans are disbursed maintaining loan portfolio average maturity constant. Reduction in liabilities average maturity would cause changes in funding sources cost and, therefore, variations in the intermediation margin. In short, dynamic interrelation between interest rates, maturities and the amounts of lending and deposits amounts, constitute a balance sheet structure for each moment in time, and an endogenous dynamic for the intermediation margin.

Regarding contagion risk, if during the horizon analysis institutions do not comply with regulatory limits of total capital or common equity tier 1, or do not have sufficient liquid assets to cover their minimum liquidity requirements, it is assumed that they would default their obligations. The loss caused to other institutions because of these defaults implies a decrease in profits and an increase in liquidity requirements, which in turn would affect total capital and liquidity indicators. In the event of exceeding the regulatory minimum, new defaults in the system by affected institutions could happen.

c. Transmission mechanisms to the capital ratio

Finally, capital ratios, which incorporate credit institutions' information on balance sheets and income statements movements in the hypothetical scenario, are calculated.

The set of impacts of the hypothetical scenario, together with credit institutions endogenous behavior, would weaken institutions balance in each period, and generate changes in the capital ratios through a set of transmission mechanisms.

The first channel consists in the fall of profits, product of the following factors: (i) larger provisioning expenses, as a result of a breach of the obligations of other credit institutions and credit risk materialization, (ii) valuation losses generated by credit risk materialization, and (iii) the evolution of the intermediation margin, which is affected by credit institutions rates and terms structure in accordance with interest rate risk materialization.

The second channel is the variation of risk level weighted assets attributed to loan portfolio dynamics. This dynamic responds to the allocation of available resources of institutions which, according to the reinvestment rule, is affected by funding and liquidity risks, and by capital regulatory limits.
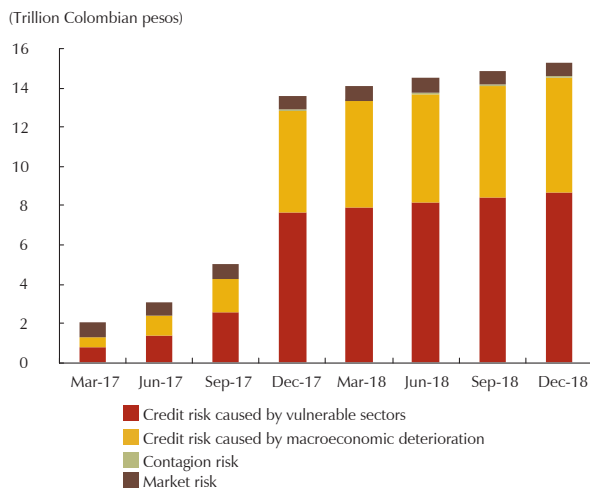
The last channel is related to mortgage and microcredit general provisions increase. This affect equity, to the extent that the regulation allows institutions to account for these additional provisions as additional equity in an amount that does not exceed 1.25% of risk level weighted assets.

The above mechanisms would affect institutions capital ratio since they would decrease additional equity growth, if profits are positive[62]. Also, capital ratio would be affected by risk level weighted assets endogenous behavior. In the case in which losses generate negative earnings, these would directly reduce common equity tier 1 capital.

4.   Results

Towards the end of the horizon of analysis, cumulative losses caused by risks materialization would amount to 20.4% of the aggregate capital of the system.

Credit risk caused by vulnerable sectors
Credit risk caused by macroeconomic deterioration
Contagion risk
Market risk

Source: Calculations by *Banco de la República*

Graph 46 presents the cumulative losses that credit institutions would suffer in the adverse scenario as a result of the materialization of the risks described above. The results of the test indicate that during the eight analysis periods total cumulative losses caused by these shocks would amount to $ 15.3 trillion, equivalent to 20.4% of the total capital of the system observed in December 2016. Of this total, $ 8.7 trillion would correspond to provisioning expenses caused by the credit loan portfolio quality rolling of firms belonging to civil works industries, vulnerable sectors and intervened firms; $ 5.9 trillion to the generalized deterioration to credit institutions loan portfolio quality; $ 0.7 trillion to market risk losses materialization caused by the sale of loan portfolio of securities held by foreign investors, and $ 0.1 trillion corresponding to the losses caused by contagion risk materialization between institutions.

A moderate drop in capital indicators, negative values in loan portfolio real growth rate, deterioration of the non-performing loans ratio would be observed…

Overall, credit institutions relevant variables projections would evolve in the stressed scenario in accordance with graphs 47 to 51. The non-shaded area corresponds to observed data, while the shaded one corresponds to the horizon projected by the test.

Graphs 47 and 48 feature total capital and common equity tier 1 ratios evolution for the credit institutions aggregate during the analysis' horizon, respectively.

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62   In the test, it is assumed that credit institutions undertake to capitalize on 100% of their profits.

Graph 47
Total capital ratio
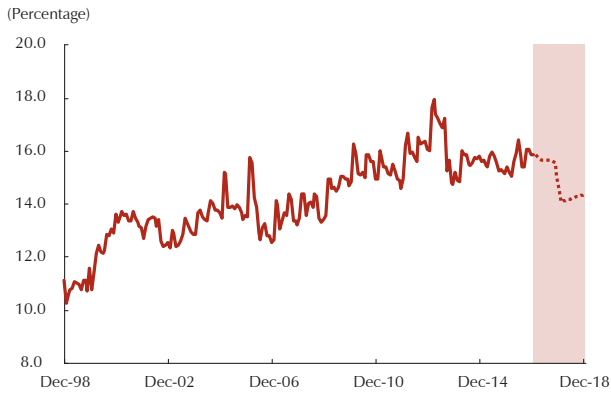
(Percentage)

Graph 48
Common equity tier 1 ratio

(Percentage)

Graph 49
Loan portfolio annual real growth

(Percentage)

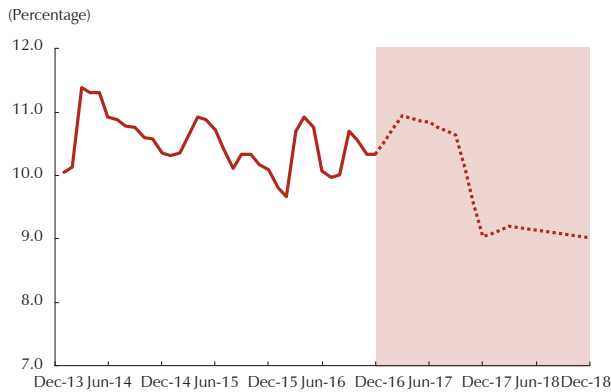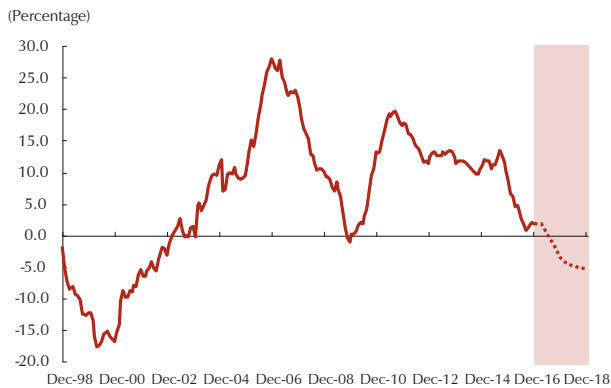The combination of shocks of the stressed scenario leads to a drop in the total capital and common equity tier 1 ratios scenario at the end of the first year of the horizon, period in which the set of shocks presents its greater magnitude and, thus, the greatest losses are registered. Although the common equity tier 1 ratio continues to gradually drop (from 10.3% to 9.0%), the total capital ratio slightly recovers, for two reasons: first, on the whole, institutions are able to keep positive profits during the second half of the test horizon, which has a positive effect on the numerator of the total capital ratio; second, the denominator of the ratio is reduced as a result of the decrease in the loan portfolio volume (Graph 49). Entities are forced to reduce the loan portfolio as a direct consequence of the drop in their cash (see equation 6).

It should be noted that, in the stressed scenario, results indicate that the real growth rate of the loan portfolio would drop to negative levels not seen since the 1998-2002 crisis. In any case, the aggregated capital ratio of the system as a whole does not fall below the regulatory minimum during the horizon. On the other hand, Graph 50 describes credit risk materialization dynamic during the analysis horizon[63]. In the latter, a sharp increase of

Graph 50
Non-performing loan ratio

(Percentage)

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63   The non-performing loan ratio is built from the massive deterioration of the loan portfolio of the adverse scenario, if the composition between productive loan portfolio and the non-productive one remains constant for each one of the ratings.

Graph 51
Return on assets (ROA)

(Percentage)
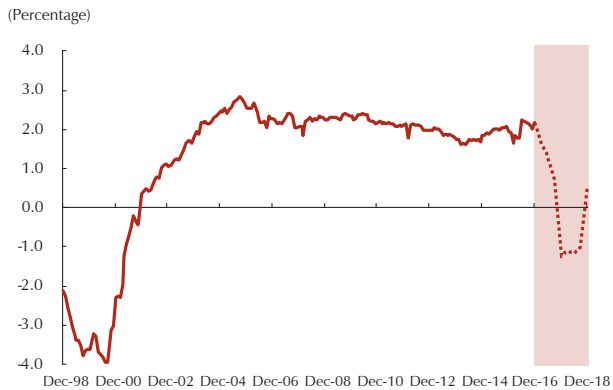

Sources: *Banco de la República* and Bloomberg (until December 2016); Calculations by *Banco de la República* (March 2017 to June 2018).

the non-performing loan ratio to levels not seen in the recent past would also be observed.

…as well as a reduction of the ROA, which coincides with periods in which macroeconomic shocks record their highest magnitude.

Finally, Graph 51 shows the evolution of the profitability of the business. Losses caused by the joint materialization of described risks would result in a decrease in the aggregate profitability of the system: ROA would fall from 2.2% to -1.2% between December 2016 and the same month in 2017, registering negative levels not seen since the crisis of the end of the century. Negative profitability persists during three quarters, which illustrates the severity of the effects of the stressed scenario on banking business profitability.

5.   Final comments

The stress test presented in this section requires a set of final thoughts in order to allow a more accurate interpretation of its features and results.

Findings indicate that in the adverse scenario credit institutions aggregated capital ratios would not fall below the regulatory minimum. At the same time, certain negative effects on loan portfolio growth, its quality and the profitability of the banking business would be observed. However, as has been mentioned, the test is built on a set of assumptions that reflects an extreme and very unlikely situation for the Colombian economy, as they imply the simultaneous occurrence of diverse shocks. On the one hand, it is assumed that economic authorities do not take actions in response to the deterioration of credit institutions financial situation. Likewise, shareholders of entities are presumed to bev excessively passive, to the extent that they only capitalize the totality of profits of institutions without taking any other kind of strategic initiative for facing financial stress. Particularly, shareholders do not inject external capital to the business operation, nor seek synergies or mergers among institutions, nor steer them with the goal of increasing operational efficiency. If any of these assumptions is removed, one would expect the magnitude of losses on the system to be cushioned, so that the impact of the adverse scenario would be smaller.

In addition, the starting point of the analysis is banking entities' individual capital ratios, without considering consolidated capital. In this regard,

results at the consolidated level may differ from those presented here, because consolidated capital current levels are different. Finally, it must be remembered that the assessed scenario is motivated by a specific set of vulnerabilities that excludes potential alternative risk sources that the financial system may face.

STRESS OF BANKING SUBORDINATES OF COLOMBIAN FINANCIAL CONGLOMERATES IN CENTRAL AMERICA

Juan Sebastian Mariño
Maria Fernanda Meneses
Daisy Johana Pacheco*

There has been a significant expansion of the Colombian banking to countries in Central America during the past ten years, which has generated a significant exposure in this region, and has increased the importance of evaluating the resilience of financial institutions who have presence in such jurisdictions, in the face of unfavorable scenarios that impact their performance. Given the above, this box will apply some methodologies of stress testing to assess the capacity of these conglomerates to face adverse situations that impact their total solvency and their profits[1].

For this purpose, various unfavorable scenarios of credit, market and liquidity risk that affect the financial indicators of subordinates are simulated, and those in turn impact the financial results of their parent companies. Scenarios are built based on observed historical figures of the individual financial statements of the analyzed subordinates, with closing date of December 2015. This exercise considered entities with a presence in Guatemala, El Salvador, Nicaragua and Honduras[2].

1. Market Risk

This exercise assumes a loss in the value of the investments of the subordinates, because of a significant settlement in the titles of public debt[3]. This loss is simulated by calculating the percentage variation in the value credit institutions in Colombia portfolio, given an increase

of 400 basic points (bp) in all periods of the zero-coupon curve in Colombian pesos[4]. The loss would lead to a fall in the profits of the subordinate, impacting its total regulatory capital and reducing its capital adequacy indicator. For the test, a 0% weighting of public debt securities in risk level weighted assets the entity is assumed.

2.   Credit risk

It is assumed that, for each subordinate, the non-performing loan indicator is increased until reaching the historical peak found in the period reported on its balance sheet. This increase would generate, on the one hand, a decline in income, given that the new non-performing loan portfolio ceases to generate interest payments; and, on the other hand, an increase in provisions spending corresponding to 100% of the loan portfolio variation. These two effects would generate a reduction in profits, which would reduce the total regulatory capital of the entity and its risk level weighted assets[5]. With the above, the capital adequacy indicator would be reduced.

3.   Liquidity risk

Because of a loss of confidence in the entity, it begins to receive resources from the public with a greater deposits rate (the maximum implicit rate registered with information of the balance sheets of the entity)[6]. This increase generates greater interest expenses, thus reducing the profits of the subordinate in the variation of such expenses. The above negatively impacts the total regulatory capital of the entity, reducing its capital adequacy indicator.

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*   Authors are professionals at the Financial Stability Department in *Banco de la República*. Views expressed here do not commit the Bank nor its Board of Directors. Errors or omissions that persist are the sole responsibility of the authors.

1   For all tests, a 100% of profits capitalization commitment is assumed.

2   By availability of information, it was not possible to perform tests for subordinates in Costa Rica and Panama. Assets of subordinates located in the four analyzed countries represent 36.5% of total external assets of analyzed conglomerates.

3   This liquidation of investments assumption is made because not all of the analyzed countries have valuation at market prices.

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4   This assumption is carried out given the lack of information on securities valuation in the analyzed countries.

5   The total increase in the portfolio is subtracted from the risk weighted assets by risk level, which is equivalent to punishing the 100% of the variation in the portfolio.

6   The implicit deposits rate is calculated as the ratio between interest expenses and total deposits.

4. Joint risk

For assessing the impact that the simultaneous materialization of the three proposed shocks would have, the losses of each subordinate are added by conglomerate, subtracting the total regulatory capital of its corresponding parent company. In the same way, risk level weighted assets of the parent company are reduced because of credit risk. Both effects can generate a modification in the total capital adequacy ratio of each conglomerate

5. Results

Despite the extreme conditions of the proposed scenarios, total capital adequacy ratio and aggregate profit of Colombian conglomerates would have moderate impacts. The changes in total capital adequacy ratio would not exceed 50 bp in any of the cases, and profits would not fall more than 30% for any of the parent companies.

This test is considered as a first approximation for risk assessment of Colombian entities with presence in Central America. It is expected that having more information test may incorporate improvements in methodologies applied here.

Box 4:
STRESS TESTS IN DEFINED CONTRIBUTION PENSION SCHEMES

Juan Carlos Mendoza
Santiago Segovia*

1. Introduction

In the year 2014, the International Organization of Pension Supervisors (IOPS, 2014) published a paper on the performance of stress tests in different pension schemes. In general, the organization highlighted that for defined benefit (DB) pension schemes[1], stress tests usually focus on quantifying if pension funds managers have sufficient resources to fulfill their pension obligations. Regarding defined contribution schemes (CD)[2], it is not clear which must be the objective of this type of tests, since the investment risk of these funds is assumed directly by the affiliates and not by the pension funds managers.

Likewise, the document presented the results of a study that used information about the existing pension schemes in 30 countries, finding that:

a. In 40.0% of the cases, the pension funds' supervisor performs some kind of stress tests.
b. 53.0% of pension funds carry out their own tests, although in very few cases it seems to be mandatory to do so.
c. 33.0% of the countries does not make any kind of stress tests.
d. Most of the stress tests use methodologies to assess market risk (value at risk: VaR, interest rate shocks, among others).

Thus, this box presents the main lessons of the study made by the IOPS, along with a first approximation of how to implement a stress test for the CD scheme in Colombia --*régimen de ahorro individual con solidaridad* (RAIS)--, taking into account the considerations of the IOPS.

2.   Stress tests in different pension schemes: main lessons

According to the results found by the IOPS (2014), there are very few experiences of how to perform stress tests on pension funds at the international level. In fact, not all of the surveyed countries carry them out, and those who do so seek to assess the change in the value of portfolios of pension funds managers, under the occurrence of certain market shocks (Chart B4.1).

Table R4.1
Types of stress tests by country

Risk valuation/ methodology	Countries	
Market risk: VaR and minimum return guarantee, profitability regarding certain benchmark	Germany	Hungary
	Austria	Israel
	Chile	Italy
	Colombia	Macedonia
	Spain	Poland
	Great Britain	Romania
	Holland	Thailand
	Hong Kong	
Sensitivity analysis: changes in interest rates / or exchange rates	Germany	Iceland
	Brazil	Israel
	Chile	Jamaica
	Colombia	Poland
	Hong Kong	Tailandia
	Hungary	
Scenario analysis: shocks to business variables (GDP, unemployment, interest rate, exchange rate) and financial variables	Austria	Macedonia
	Costa Rica	Czech Republic
	Spain	Romania
	Holanda	
Funding risk: stress on the funding ratio	Germany	Iceland
	Holland	Jamaica
	Hong Kong	

Source: IOPS (2014); made by authors.

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*   Authors are, in this order, expert analyst, and analyst at the Financial Stability Department of *Banco de la República*. Views expressed here do not compromise the Bank nor its Board of Directors. Errors or omissions that persist are the sole responsibility of the authors.

1   Defined benefit pension schemes are the ones that ensure a fixed income flow for pension funds' affiliates that meet the conditions for their retirement. In the case of Colombia, this scheme is represented by the *prima media* regime.

2   In this scheme, the value of the pension depends on the contributions made by affiliates during their working life, which represent a fixed percentage of the earned salary.

Among the most common tests, VaR estimation for owned and managed portfolios of pension funds managers is done, as well as the verification of compliance with the minimum profitability requirement under a stressed scenario (e.g. low profitability level during a given period). On the other hand, in some countries these shocks are complemented by sensitivity tests, in which the change in value of portfolios to movements in a particular variable (interest rates, exchange rates, among others), or to adverse macroeconomic scenarios is calculated. For BD schemes, tests are done in order to analyze how the funding level or fund coverage change under variations in interest rates or funds' return.

Given these results, the IOPS concluded that analyses performed in different countries are not appropriate when evaluating the performance of portfolios managed by pension funds managers, particularly for CD schemes. In fact, market movements affect the value of assets in the short term; however, the ultimate purpose of contributions to a pension fund is to ensure a certain level of savings that would allow an individual to retire with an adequate pension.

In this sense, given that in CD schemes, the affiliate is the one who faces investment risk, the objective of stress tests must be to evaluate if under an adverse scenario, the affiliate will be able to obtain an adequate pension. In this way, according to the literature, the IOPS recommends that the target variable of these tests should be the replacement rate, which is defined as the ratio between the value of the pension and the value of the last earned salary[3]. When considering both the accumulation and the decumulation stages, this variable takes into account the whole life cycle of the affiliate.

Since the replacement rate depends on the value saved by the affiliate, it will be affected by changes in the contribution rate, contribution density, portfolio returns and by the base income for making the contributions[4]. On the other hand, the value of the pension will be modified in accordance with the affiliate's life expectancy, the real rate, long-term inflation, among others. In this way, stress tests should be designed in a way that it can be determined how, under extreme scenarios, the movement of the described variables can modify the affiliates' replacement rate.

3.   Sensitivity test for the Colombian case

In order to perform a sensitivity test for the CD scheme in Colombia, a simulation was made for a representative affiliate based on the methodology proposed by Arias and Mendoza (2009), using the following assumptions:

a.   The affiliate begins to make contributions at 20 years of age and retires at 62. This pension age corresponds to men's retirement age in the prima media regime in Colombia. In this way, the accumulation phase will be of 43 years.
b.   Contribution rates are given, and are defined according to enforceable regulations in Colombia[5].
c.   The representative affiliate will have the same salary throughout his entire working life. In the simulation, the salary increases in the same proportion the minimum wage does (i.e. inflation plus an adjustment factor that was defined following historical evidence).
d.   For modelling profitability, it is assumed that this variable follows a stochastic process defined by a Brownian motion, which is common in financial literature. In order to define the mean and volatility of this stochastic process, annual returns observed for the moderate fund between March 2011 and December 2016 were used[6]. In this way, the baseline scenario was constructed using an average annual return of 6.7% and a volatility of 2.8%.
e.   The contribution density is calculated with information that pension funds managers report to the Financial Superintendent of Colombia.

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3   For example, if the last monthly salary received by an individual was of COP 5 million (m), and the monthly value of the pension is COP 2.5 m, its replacement rate will be equal to 50.0%.

4   The contribution rate is the percentage of the base income which is paid to the affiliate's account in the pension fund. The contribution density indicates the average proportion of weeks or months in which an affiliate makes contributions during his working life.

5   Currently, the percentage of contributions for compulsory pension is 16.0%, where 12.0% is the responsibility of the employer and the remaining 4.0% of the affiliate. Of this 16.0%, 11.5% goes to the individual savings account of the affiliate, 1.5% for the minimum pension fund, and the remaining 3.0% for paying pension insurance and the commission fee to pension funds managers for administrating the resources contributed.

6   Parameters of the moderate fund were taken, given that more than 80% of the RAIS' affiliates are inscribed in this fund. In addition, parameters of the conservative fund were used to simulate the last 5 years of the affiliate's contribution stage, because current regulation obliges pension funds managers to transfer the resources to this fund when the affiliate has 5 years less than the pension age of the *prima media* regime. This transition is made gradually, transferring 20% of savings each year, so that at the pension age, the affiliate has 100% of savings in the conservative fund.

f. For mortality tables, those established by the Office of the Financial Superintendent of Colombia in Resolution 1555 of 2010 are used.

g. Long-term inflation used in the test is of 3.0%.

The aim of the exercise is to assess how the replacement rate of the representative affiliate changes under variations in the contribution density and in the portfolio's long term return. Effects on the replacement rate are measured differently for men and women, since some of the parameters of the simulation are different (e.g. number of years of the contribution stage and life expectancy).

In the case of contribution density, variations of -15 and 15 percentage points (pp) from the baseline scenario were considered[7]. As it can be seen in Graph B4.1, women's replacement rate exhibits a lower sensitivity to changes in contribution density. For example, if contribution density for both men and women decreases in 5 pp, the replacement rate would decrease by 3.2 percentage points in the case of men, while for women this decrease would be of 2.9 pp.

Graph B4.1
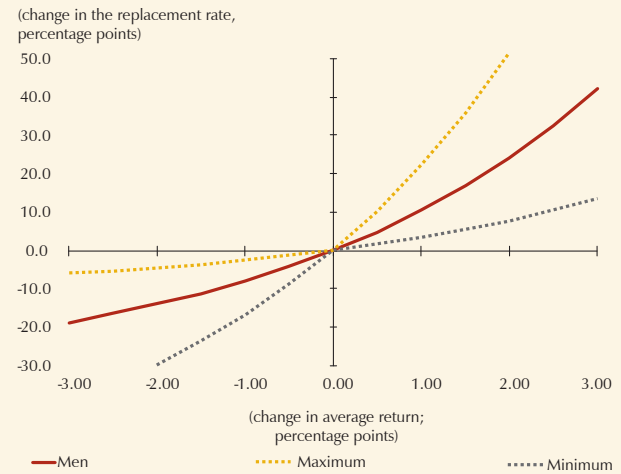Sensitivity of the Replacement Rate to changes in Contribution Density
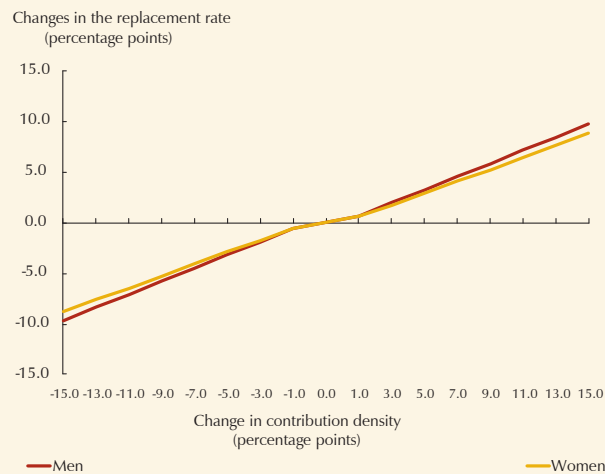
Source: Financial Superintendent of Colombia; authors' calculations.

In addition, the effect on the replacement rate of variations in the return rate of the compulsory pension portfolio was estimated. These variations correspond to profitability levels of assets that make up the portfolio, and not to changes in the long-term real interest rate. Results indicate that if average profitability of the port-
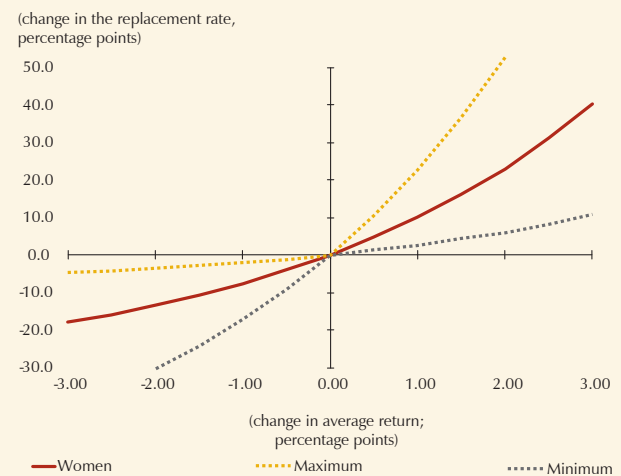
folio of compulsory pensions was 3 pp lower than the mentioned average value (6.7%), the replacement rate of men would decrease by 18.8 pp, while the women's replacement rate will decrease in 17.9 pp (Graph B4.2).

Graph B4.2
Sensitivity of the replacement rate to changes in portfolio's return

A.   Men

B.   Women

Source: Financial Superintendent of Colombia; authors calculations.

In general, it is found that there is a greater sensitivity in the replacement rate of men compared to women's, under the evaluated shocks. These findings are due to the differences that exist in life expectancy and in contribution densities between both genders. On the one hand, given that women have a higher life expectancy, variations in savings done during the accumulation stage, affect to a lesser extent the value of the pension, since savings will have to be distributed in more periods. On the other hand, due to the fact that women regis-

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7   These variations may respond, among other factors, to changes in both levels of informality in the economy and the unemployment natural rate.

ter lower average contribution densities, changes in the portfolio's return affect, to a lesser extent, the total value of savings, and therefore their replacement rate[8].

4.   Final Considerations

According to international evidence, in most of the countries, stress tests that are carried out have a short-term character. For this reason, it is important that regulatory authorities consider other type of tools to evaluate pension funds' performance under adverse scenarios. Since these analyses consider a long-term horizon, the design of these exercises is not easy to implement; however, it is important to promote discussion regarding this topic.

Lessons from the IOPS allow inferring that, when performing stress tests for pension funds managers, it is important to be consistent with the objective and the analysis horizon of the pension scheme. Given that in the CD scheme investment risk relies entirely on the affiliate, generating uncertainty about the value of the pension that he/she is going to receive, a proper variable for evaluating the performance of this pension scheme under adverse scenarios is the replacement rate.

In the exercise carried out for the Colombian case, it is found that men's replacement rate is more sensitive to variations in both contribution densities and portfolio returns compared to women's. This is mainly explained by differences in life expectancy and in contribution densities between both genders.

Another variable that would be relevant for analyzing the performance of the RAIS is the probability of retirement. In Colombia, the pension value of an affiliate of the social security system cannot be lower than a minimum wage, which implies that they must save a minimum amount during their contributive stage to obtain a pension. In addition, if they cannot reach this minimum amount, affiliates can access the benefits of the minimum pension fund if they have a minimum of age and number of weeks contributing. In this way, contribution density rates, the pension fund's return, among other variables, are relevant at the time of evaluating how adverse scenarios would affect the probability of obtaining a pension.

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8   Differences that exist in contribution densities and in life expectancy between men and women, makes the latter have on average, for all salary ranges, a lower level of replacement rate. In order to make replacement rates between groups the same, women must work approximately between 1 and 3 years more than men, according to the analyzed salary range.

5.   References

Arias, M. and J.C. Mendoza (2009). "Un modelo de simulación del régimen de ahorro individual con solidaridad en Colombia ". Financial Stability Issues, September.

Ionescu L. and J. Yermo (2014). "Stress Testing and Scenario Analysis of Pension Plans." IOPS Working Papers on Effective Pensions Supervision, 19, March.

IV. FINANCIAL REGULATION

This chapter provides a summary of the most important local regulatory changes in recent months, both for their impact on the performance of the financial system, as for their possible implications in financial stability.

New measures and modifications in terms of regulation were implemented between September 2016 and March 2017. On the one hand, decrees relating to rules applicable to employee funds, the payment of the deposit insurance of the Guarantee Fund for Financial Institutions (FOGAFIN) and the investment regime of insurers and capitalization companies were issued. In addition, a resolution of stock brokerage firms' guarantees fund was published, a circular with instructions related to the estimation of the expected loss for the reference model of the consumer loan portfolio, and a newsletter concerning requirements for information registration and disclosure applicable to collective investment funds were issued.

Decree 344 of 2017: rules applicable to employee funds for the rendering of savings and credit services.

Decree 344 of March 1, 2017 was issued with the aim of promoting and strengthening the soundness of the solidarity economy industry, by broadening prudential regulation mechanisms applicable to employee funds. The decree dictates provisions with respect to the types of funds to which capital requirements and concentration limits apply, as well as regarding information mechanisms on the existence and constitution of such organizations.

In the first place, it is established that employee funds will be classified into three categories, according to their level of assets reported as of December 31 of the previous year: 1) Basic: funds whose amount of assets is less than COP 3.6 billion; 2) intermediate: funds with assets between COP 3.6 billion and

COP 10 billion, and (iii) full: funds with assets greater than COP 10.0 billion. Office of the Superintendent of Solidary Economy (SES, Superintendencia de Economía Solidaria) may reclassify those funds of an intermediate category into the full category, provided that the association link of the respective Fund differs from the exclusively generated by the same company or public or private institution, or of several companies in which business unity is declared, or for parent companies and subordinated, or of major entities and attached and linked, or of companies that are integrated making a business group. Each year there will be an updating process of classification, intermediate category funds shall certify the existing association link in their statutes, in which the nature of the companies their associates belong to is specified, with the purpose that the SES can verify its proper classification. If the supervisor considers that this classification does not conform to the real nature of the fund, he/she can make use of the faculty for reclassifying it in the full category. Based on the above, the decree establishes prudential norms on capital adequacy and concentration limits, applicable to employee funds belonging to the full category.

Regarding capital, regulation is in line with efforts made by the authorities so that all entities of the financial system and the solidarity sector have measurements that ensure a good quality capital. In this sense, employee funds must comply with a minimum soundness indicator of 9%, defined as the relationship between consolidated capital and risk weighted assets. The first is comprised of common equity tier 1 capital[64], net of deductions[65], and tier 2 capital; while the second[66] includes funds' assets and contingencies, weighted by a factor that considers the assets' risk features. The decree clarifies that the loan portfolio of institutions shall be computed in risk weighted assets net of social contributions and savings from associates.

As for concentration limits, it is established that the maximum amount of credit operations to an associate or group of associates, shall not exceed 10% of the entity's regulatory capital. This percentage may be of 15% in case operations have sufficient guarantees[67]. If a transaction exceeds 10%, it must be reported monthly to the Board of Directors of the entity. The SES will be responsible for ensuring compliance with requirements, both of the minimum capital soundness indicator, as well as concentration of operations control; in particular, this Superintendence shall set the periodicity for the

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64   Within the items that make up common equity tier 1 capital, there is the social contributions protections reserve and donations, if they are irrevocable.

65   Intangible assets and the calculation of the pension liability are within deductions.

66   Regarding risk-weighted assets, the requirement is similar to that of credit institutions; weights are fixed and depend on assets' risk level, with a larger risk resulting in a higher weighting.

67   An admissible warranty may be one that has a value sufficient to cover the operation throughout its duration, or that is legally supported for the payment of the obligation.

verification of said limits, and shall have a term of three months to publish the necessary instructions for the fulfilment of the provisions of this decree.

Finally, it was decreed that employee funds, particularly those belonging to the full category, will have to submit to the SES a series of documents that support the constitution process of the entity and the corresponding feasibility studies and projections of the entity for the next five years. The SES may request the documents referred to at the time it deems necessary. For funds that are already established and that belong to the full category, a two-year period of implementation of the requirements was established, which can be extended to four in special cases. In six months, the plan of action for said compliance shall be submitted.

Decree 119 of 2017: general scheme of foreign capital investment in Colombia and of Colombian investments abroad

The decree provides for an integral modification of the international investments regime. Within the main changes, the following aspects are highlighted:

1. The concept of "permanency", both for nationals as for foreigners, is incorporated in the definition of resident, to make it consistent with the tax residence norm included in the tax code.

2. "Investment modalities", as defined in Decree 2080 of 2000, are eliminated and the definition of investment of foreign capital in Colombia and of Colombian investments abroad is adjusted, in order to recognize investment in assets purchased under any legal title, by virtue of an act, contract or lawful operation[68].

3. The faculty of an investor to register as direct investment or portfolio investment those made in shares in companies registered in the National Register of Securities and Investments (RNVE, *Registro Nacional de Valores e Inversiones*), stating whether these have been acquired with intention of permanence or not.

4. Registration statements must be submitted according to the procedure established by *Banco de la República*. Investors, their agents or legal representatives of investment reception companies may, at any time, modify the information contained in the registry.

68　　Previously, investment of foreign capital in Colombia, as well as Colombian investments abroad, had certain modalities defined in Decree 2080 of 2000. For example, foreign capital invested in Colombia could be in the form of import of freely convertible currency for investment in national currency, while Colombian investments abroad might correspond to the export of tangible goods, such as machinery, equipment, or other physical assets, or the export of foreign currency as a direct contribution of capital to a company.

5. Registration statements' information is deemed submitted under oath and, in this regard, the accuracy and completeness of the information provided will be the sole responsibility of the investor or of the one providing it, reason why there will be no examination or rating of it for registration purposes.

6. The new international investment regime shall be applicable once *Banco de la República* issues the corresponding regulations, for which it has a six- month term following the date of issuance of Decree 119 of 2017.

Decree 1848 of November 15, 2016: modification of the structure of the Office of the Financial Superintendent of Colombia.

At the end of 2016, the SFC announced a major change in its structure, motivated by the challenges and complexities that the adoption of an integrated supervisory scheme, like the one promoted from within the entity, supposes. In essence, proposed changes seek to minimize the duplication of monitoring efforts, through, for example, the strengthening of the dialog between the Superintendence and the supervised entities, and the solidification of the mechanisms and coordination for getting a consolidated view of supervised entities. The previous model, in which there was a simultaneous interaction of the different areas with supervised entities, promoted a segmented diagnosis of the latter.

The changes made at the SFC also respond to a series of recommendations made by various international organizations (IMF, OECD, Toronto Centre and First - World Bank), which highlighted the importance of improving the structure of the entity. The latter, with the purpose of strengthening comprehensive monitoring, improving consolidated supervision of financial conglomerates, and of centralizing the responsibilities and the representation of the SFC compared to its monitored agents, all in order to optimize supervision resources and to eliminate the duplication of functions.

Decree 1535 of 2016: administrative forced liquidation process and the payment of FOGAFIN's deposit insurance

On September 29, 2016 Decree 1535 was issued, which amended some parts of Decree 2555 of 2010, in connection with the role of FOGAFIN. On the one hand, it was established that said entity may submit claims to the settlement agent of a financial institution, up to an amount equivalent to the total value of deposit insurance, in a period not exceeding one month from the date that has been set for filing claims. Depositors of the institution in liquidation with credits covered by the deposit insurance, may not formulate claims; a depositor may only submit claims for amounts exceeding insurance coverage.

On the other hand, regarding the valuation of the assets of the financial institution under liquidation, the decree amended the time set for the liquidation agent to accept the valuation of the inventory, and it was established at three months, with the possibility of extension by FOGAFIN (before, the deadline was of one month).

Decree 1523 of 2016: temporary registration of values at the RNVE.

Decree 1523 aims to include those entities which are in liquidation and that are not registered at the RNVE, within the group of entities that can resort to the SFC to authorize their registration on a temporary basis. The latter would allow them to carry out the process of disposal of proprietary shares or convertible bonds, via public offering in the secondary market. It is stipulated that costs associated with the temporary registration to the RNVE shall be borne by the transferor, and not by the one whose securities are temporarily registered.

The temporary registration of securities at the RNVE does not imply that the shares or convertible bonds are automatically registered in a stock exchange. However, the decree allows those securities to be registered at a stock exchange to carry out the public offering, if it is so decided. Additionally, it includes the possibility to establish specific conditions in the sales plans for the disposal of the securities, such as minimum or maximum amounts to be acquired, to ensure an adequate provision of services by those entities whose shares or convertible bonds are registered on a temporary basis.

Decree 2103 of 2016: Insurance entities and capitalization companies' investment regime

Decree 2103 modifies the technical reserves investment regime of insurance and capitalization companies. Main changes introduced in the decree are: 1) inclusion of a new category called "restricted instruments," and the establishment of investment limits associated with said instruments; 2) identification of instruments that make up alternative assets, and the establishment of the respective investment limits; 3) modification of existing limits, and 4) other clarifying adjustments.

With respect to restricted instruments, the decree establishes the financial investments that make up this new category, which includes shares in leveraged collective investment funds or in hedge funds. Also, the investment limit associated with this category for CSV is set, which corresponds to 1.0% of the portfolio value that supports technical reserves. CSG and capitalization companies do not have a limit for this particular category, although they are explicitly prohibited from investing in some of the instruments that comprise it, for example, non-registered shares at the RNVE or participations in open-ended

funds with lock-in periods or closed-ended funds. Investments in other restricted instruments are limited by other global investment guidelines[69].

Regarding alternative assets, which include restricted instruments, investments in private equity funds, shares in real estate collective investment funds, as well as those in commodity and currency funds, are highlighted. In addition, global investment limits in this type of assets were increased: in the case of CSV, there was a 5.0% limit for participations in private equity funds constituted abroad, which now extends to 25%, but covers all the instruments considered as alternative assets (which include such capital funds). In the case of CSG and capitalization companies, a 10% limit for this category is created, although unlike the CSV, alternative assets exclude shares in hedge funds.

On the other hand, the decree also modifies some of the existing global investment limits, both for the life insurance and general insurance sectors. Among other changes, in the investment regime of the CSV, the 5.0% limit that existed for participations in private equity funds established in Colombia, as well as for those constituted abroad, was unified in a single limit of 10% for the joint participation in these funds[70]. Also, the limit for investments in productive real estate located in Colombian territory was expanded from 2.0% to 3.0%. Regarding the latter, the new regulation excludes it from the list of instruments not eligible for CSG and capitalization companies, and allows them to invest up to 1.0% of the portfolio that supports the technical reserves in this instrument.

Finally, the project formulates other changes that are worth highlighting: 1) when referring to investments in closed-ended collective investment funds, the maximum participation an insurance or capitalization company can have is increased from 30% to 50% of the collective investment fund's equity[71]; and 2) admissibility conditions of some investments are defined (for example, participations in index, fixed income, commodity or foreign currency funds, and hedge funds), among which it is worth mentioning: that the credit rating of the country where the fund is constituted must correspond to investment grade and that the net asset value must be disseminated through public systems of financial information.

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69   For example, investments in *hedge funds* would be bounded by the existing global limits for securities or shares from foreign issuers (40%) and those for unhedged foreign currency investments (35%).

70   The new limit exempts real estate private equity funds.

71   In any case, when such investment exceeds 30% of the collective investment fund's equity, the Board of Directors of the entity shall approve such investment. This limit shall apply in the same percentage and under the same conditions when the investment is in private equity funds.

Resolution 1077 of 2016, and resolutions 0080 and 0081 of 2017: Guarantees Fund of the Brokerage Firms of the Colombian Securities Exchange (FOGACOL)

On March 17, 2016, the Trustors General Assembly of the Guarantee Fund of the Brokerage Firms of Bolsa de Valores de Colombia (FOGACOL) confirmed the occurrence of the condition laid down in article 6.3.1.2 of the General Rules of Bolsa de Valores de Colombia, which established that, once the autonomous equity of the Replacement Fund of the Guarantee Fund of Stock Brokerage Firms of Bolsa de Valores de Colombia (FONREP) reached the amount of the special purpose vehicle (SPV) FOGACOL, by decision of the corresponding administrative authority, the SPV FONREP could assume the role of the guarantee fund.

Given the above, two processes of formalization of the decision were undertaken before the SFC:

1. On August 25, 2016, by means of Resolution 1077, the supervisory body approved the amendment of the rules of SPV FONREP, making it a guarantee fund. The new regulation incorporated, not only the original functions of FOGACOL (i.e., to respond to the customers of the stock brokerage firms, including investment funds, for the fulfilment of the obligations they have undertaken in the development of the commission and administration of securities' contract), but some additional ones relating to support of stock brokerage firms' liquidity and capital. In particular, the new regulation allows the guarantee fund to grant loans to stock brokerage firms with the purpose of restoring their capital soundness or liquidity needs, as well as acquiring assets or debt securities issued by entities that are part of the Fund.

   In addition, given that the former replacement fund now takes on the quality of sole guarantee fund, the new regulation provides for a change in the replacement mechanism of the minimum capital of the fund, which used to be solved with a transfer of resources from FONREP to FOGACOL. Now, the replacement mechanism is directly constituted by contributions from the entities registered at the fund, and depend on the size of the gap. Specifically, if the decrease in resources is less than 10% of the funds' minimum capital[72], the Management Council of the fund must decide whether it is necessary to request an extraordinary contribution to brokerage firms[73]. In case the gap is higher than 10%, the Management Council must

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[72] The minimum amount of capital of the fund was of COP 12 billion in 2016. This value must be updated on the first working day of each calendar year based on the change in the CPI of the preceding year.

[73] Brokerage firms, in an ordinary manner, contribute to the guarantee fund. The latter depend on the value of buy/sell operations made under the commission contract, as well as on the outstanding amount of securities under management at the closing date of each month.

determine an adjustment plan which states the deadlines, conditions and amounts of the extraordinary contributions in order to restore the minimum capital . The adjustment plan must be authorized by the Board of Directors of the Securities Exchange.

2. On January 16, 2017, through resolutions 0080 and 0081, the SFC ordered to cancel the entry in the National Registry for Agents of the Securities Market of the SPV FOGACOL and, on the other hand, authorized the registration of the SPV FONREP.

External Circular 047 of 2016: instructions related to the estimation of the expected loss for the consumer loan portfolio reference model

The SFC, complying with its task of promoting an adequate credit risk management from supervised entities, changed the calculation of the expected loss for the consumer loan portfolio, adding a maturity adjustment applicable to all its modalities. The adjustment consists of weighing the expected loss by a factor that considers those credits that were agreed upon or have a residual maturity of more than six years. Calculation of the expected loss is the following:

Expected loss = probability of default.
Exposure at default
Loss given the default

Where, maturity adjustment = $\frac{residual\ maturity}{72}$

Credit card and revolving loan segments will have a maturity adjustment equal to 1. Similarly, in the case where the residual maturity is less than 72 months, the adjustment factor will also have a value of 1. The new calculation came into effect on December 1, 2016 and is applicable to loans that originate or are disbursed as of said date.

BVC Normative Bulletin No. 002 of March 2, 2017: requirements for the registration and disclosure of information applicable to collective investment funds

The modification of the Circular Única of the BVC, on its chapter II regarding Information, is related with the registration and disclosure of information to market participants' requirements, that allow investors to know the features of the collective investment funds in more detail, including private equity funds. This regime applies to both collective investment funds and private equity funds whose legal regime authorizes the issuance of securities and who are intended to be registered at the Securities Exchange, as well as for those already registered.

The regulatory change is based on the modification introduced recently by the SFC to its Legal Basic Circular by means of External Circular 054 of 2016. The latter is related, on the one hand, with greater access to information by the financial consumer on direct or indirect investments through factoring operations in securities and/or other rights of economic content made by collective investment funds and, on the other hand, with measures to strengthen the internal audit and risk management regime that responds to needs typical to investments in this type of securities.

In accordance with the above, the main change is that, before, certain information of financial, commercial and legal character was required on the website of the securities issuer. However, this did not apply to issuers of securitization processes, public debt securities issued, endorsed or guaranteed by the nation or by *Banco de la República*, pension bonds, securities issued by FOGAFIN and securities issued by autonomous SPV funds and by collective investment funds whose legal regime allowed them to issue securities. With the change, the exception referred to is no longer applicable to collective investment funds, and the information requirement now applies to them. In this case, information refers to, among other aspects, the rules of the fund, the current ranking report of the management company as administrator of portfolios or third-party resources, the certificate on know-your-client policies and the control mechanisms against money laundering and the financing of terrorism.