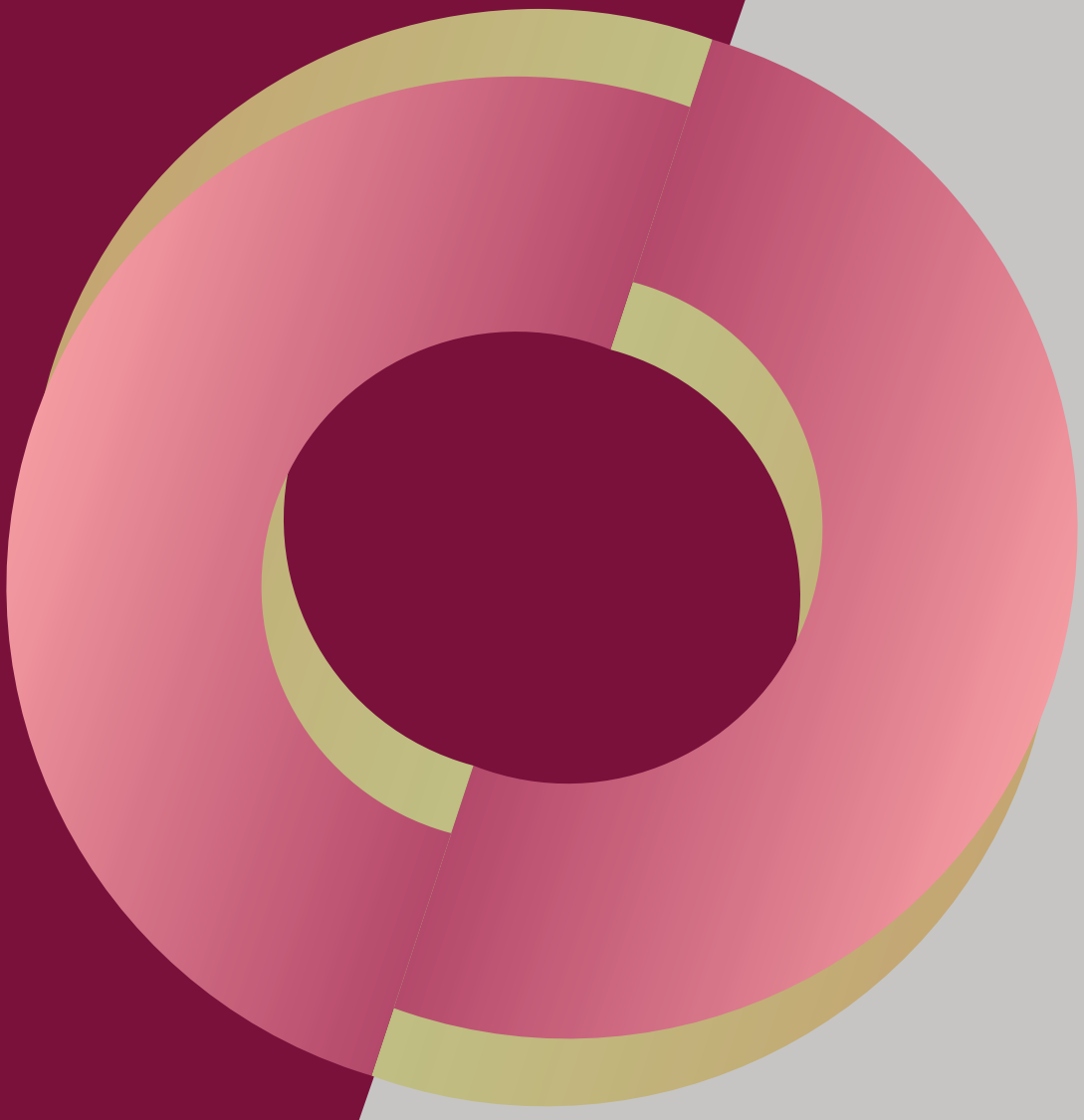
FOREIGN RESERVES MANAGEMENT

ISSN - 2145 - 6518



2021

2021

FOREIGN RESERVES MANAGEMENT

Banco de la República
Bogotá, D. C., Colombia

ISSN - 2145 - 6518

FOREIGN RESERVES MANAGEMENT

Prepared by:
The International Investments Department

Office of the Deputy Technical Governor
Hernando Vargas H.
Deputy Technical Governor

Office for Monetary Operations and International Investments
Pamela Cardozo O.
Chief Officer for Monetary Operations and International Investments

International Investments Department
Diego Felipe Cifuentes P.
Director

Sub-Directorate for Portfolio Management
Andrés Cabrales U.
Deputy Director

Jack Bohm S.
Carlos Espinosa R.
Santiago Guerrero V.
Nicolás Rubio R.
Philip Symington A.
Laura Rodríguez O.
Laura Rincón S.

Sub-Directorate for Risk Management
Gladys Andrea Galeano R.
Deputy Director

Sara González R.
Sergio Hernández D.
Cristiam Rincón R.
Daniel Ortiz R.
Ángel Pedreros
Juan Pablo Guerra T.

Sovereign Funds and Technical Support Section
Ingrid Marcela Sierra H.
Head

Mónica Rodríguez A.
Mariana Escobar V.
Mónica Rengifo U.

Information Development and Management Section
Pedro Sorza M.
Head

Nicolás Díaz R.
Camilo Restrepo V.
Yesenia Silva D.

Research and Analysis Group
Miguel Gómez R.
Daniel Díaz P.
Cristian Camilo P.

Content

Graphs

Tables

Glossary

***Back office**:* the division of a portfolio management organization that oversees confirmation, reconciliation, clearance, settlement and keeping an accounting record of operations carried out during the investment process, including operational aspects of the relationship with counterparties

Balance of payments: a record of all a country's economic transactions with the rest of the world; includes information on the value of trade in goods and services, as well as transfer payments.

Benchmark: a basket of assets or a theoretical portfolio with predetermined weights according to certain rules that define the composition of the index. In general, a benchmark index intends to replicate broadly the performance of a market for financial assets and serves as a performance indicator for other investment portfolios in that same market.

Bond: a financial debt contract in the form of a security that stipulates specific repayment of capital or principal to the holder, plus the respective interest.

Conditional VaR (CVaR): a market risk assessment measure that estimates the average loss on an investment portfolio in extreme scenarios. CVaR is calculated as the expected value of losses in the tail of the return´s distribution.

Contractual interest rate (coupon rate): interest rate associated with a debt instrument for which the issuer agrees to pay at agreed dates and predetermined intervals. It is measured as a percentage of the principal that is expected to be recovered when the debt security matures.

Correspondent banks: institutions that make or receive payments and provide other services on behalf of another bank outside the country. These include treasury correspondents.

Counterparty risk: a type of credit risk that occurs when one of the parties involved in a financial transaction might go bankrupt before it meets its contractual obligations.

Credit event: refers primarily to 1) deterioration in the creditworthiness of bond issuers or bonds themselves, or 2) default or non-payment by an issuer. According to the International Swaps and Derivatives Association (ISDA), a credit event can be any of the following: 1) the entity in question filing for bankruptcy; 2) accelerated settlement (a situation where an obligation may have to be settled prior to maturity due to a credit event experienced by the entity in question); 3) payment default; 4) debt restructuring (a change in the terms agreed on by the issuer and holder of the debt, which usually causes the debt to be less favorable for the debtholder); 5) repudiation or 6) moratorium.

Credit risk: the prospect of the occurrence of credit events such as: 1) deterioration in the creditworthiness of the issuer or the securities themselves, or 2) default or non-payment by the issuer.

Credit risk rating (credit rating): a rating issued by specialized international agencies (Standard & Poor's, Moody's and Fitch) that reflects the payment capacity or credit worthiness of an issuer of debt securities.

Current account of the balance of payments: the value of exports minus the value of imports, plus net factor income from abroad, plus net transfers from abroad.

Custodians: financial institutions (often banks) in charge of holding customers' financial assets for safekeeping (in custody). Occasionally, custody includes the exercise of rights pertaining to the maturity of the securities.

Effective duration: a measure of risk that takes into account how changes in interest rates affect expected cash flows. It considers the effect of the discounted cash flows that occur at different interest rates, as well as the changes in cash flows. This is a more appropriate method for any bond with an embedded option (e.g., mortgage-backed securities have an embedded prepayment option that can be affected by the level of interest rates; in other words, a lower interest rate gives a mortgage holder a strong incentive to refinance his debt).

Exchange rate risk: the prospect of loss in a portfolio due to fluctuations in foreign exchange rates.

Floating exchange rate: an exchange rate regime that allows the market to determine the behavior of the ratio of one currency to another, based on supply and demand. The central bank does not intervene to control the price. Therefore, the number of Colombian pesos required to purchase one unit of foreign currency (e.g., one U.S. dollar) may vary over time.

Foreign exchange market: where foreign currency is bought and sold. There are foreign exchange markets where pesos are bought and sold for dollars, or dollars for euros, among others.

Front office: the division of a portfolio management organization that is responsible for carrying out operations and transactions in capital markets.

Gross return: total income or returns received from an investment without excluding costs for fees, taxes or other expenses associated with the financial transaction.

Issuer: an entity that issues a security or bond.

Legal risk: the prospect of having contracts that cannot be performed legally or are not documented properly, or the risk of changes in legislation that affect the Bank's obligations.

Liquidity risk: the possibility that an asset might not be readily convertible to cash and at a minimum cost.

M1: a measure of the money supply regarding means of payment and includes cash in circulation, deposits in checking accounts or checks, and travelers' checks.

M2: a measure of the money supply that includes M1, savings deposits and time certificates of deposits (CDs) with commercial banks, financial corporations, commercial finance companies and higher-order cooperatives.

M3: a measure of the money supply that includes M2, commercial bank fiduciary deposits and other sight deposits. It is also equivalent to cash in circulation, plus liabilities subject to reserve requirements.

Mark to market: a practice that involves daily valuation of an asset or portfolio at market prices to reflect its current market levels.

Market risk (or interest rate risk): exists when there are losses from the devaluation of a financial asset due to changes in interest rates in the economy.

Middle office: the division of a portfolio management organization that is responsible for monitoring all investments daily, in addition to measuring and controlling exposure to financial risks.

Modified duration: a measure of the market risk of an investment portfolio or security, defined as the percentage change in the value of the portfolio or security due to a 1% change in interest rates.

Monetary aggregates: measure of the total amount of money in circulation in an economy. The main monetary aggregates are M1, M2 and M3.

Mortgage-backed securities: instruments with a value and flow of payments that is guaranteed by a basket or portfolio of assets or mortgages. Agencies' mortgages are also guaranteed by the leading government-sponsored mortgage enterprises in the United States (Fannie Mae and Freddie Mac) should the debtor default.

Net return: income or return received from an investment after deducting costs for fees, taxes and other expenses associated with the financial transaction.

Operational risk: the prospect of loss resulting from inadequate or failed internal processes, technology or infrastructure, errors committed by people, events originating with external sources or fraud.

Primary market: the market where newly issued securities are offered for sale.

Rate of return: the interest rate used to discount to present value all the future cash flows from a security (interest and principal), so the sum of those discounted amounts is equivalent to the market price of the security. The annualized rate of return on an investment in a debt security, calculated assuming the investment is held to maturity, all contractual payments are made, and interest payments (coupons) are reinvested at that same rate of return.

Reputational risk: risk that arises when harm to an organization occurs due to loss of its credibility or good name.

Risk: the prospect of loss by investing in any type of financial asset.

Secondary market: the market where financial instruments are bought and sold after first being placed on the primary market. The secondary market gives liquidity to bonds and securities that already exist.

Sovereign entities: generally, refers to states (countries) that have sovereignty; in other words, those that exercise and have supreme and independent authority to act autonomously in the management of internal relations and in determining their conduct towards other states.

Special drawing rights (SDR): an artificial reserve asset created by the IMF and assigned to its member countries in proportion to their quotas. The value of special drawing rights is defined according to a basket of currencies, which currently includes the U.S. dollar, the euro, the pound sterling and the yen. The benefit of SDR as a reserve asset is that countries can exchange it for the reserve currencies of other countries to deal with balance-of-payments financing needs or to modify the composition of their foreign reserves. In addition to their function as reserve asset, SDR serve as an accounting unit for the IMF and some international organizations.

Supranational entities: organizations that are beyond the realm of governments or national institutions and act independently of them. Generally, this term refers to multilateral organizations such as the World Bank, the Inter-American Development Bank (IDB), the Latin American Reserve Fund (FLAR for the acronym in Spanish) or the Latin American Development Bank (CAF).

Value at risk (VaR): a methodology used to measure and control market risk by estimating the maximum loss an investment portfolio can incur, with a specific level of confidence (usually 95%), in different time horizons.

Volatility: a measure of the variability of returns on a financial asset during a specific period.

Introduction

The Colombian Constitution and Law 31/1992 (Article 14) give *Banco de la República* a mandate to manage Colombia's foreign reserves, in addition to stipulating the criteria on managing these reserves, which are safety, liquidity and return. The purpose of this report is to explain how Colombia's foreign reserves are managed. As of December 2020, net foreign reserves amounted to USD 59,031.

The report begins with a description of the main concepts associated with foreign reserves and outlines the framework on which their management by the Bank is based. It then describes, in detail, the policy for managing these reserves, as well as the fundamental aspects of its operation. The report ends with a description of the current state of the country's foreign reserves.

01

The Purpose of Foreign Reserves

1.1 Definition

Foreign reserves are external assets controlled by the country's monetary authority. To be regarded as a foreign reserve, an external asset must meet the following requirements: first, it must be under the direct and effective control of the country's monetary authority and, secondly, it must be readily available for use. Colombia's foreign reserves include: 1) the investment portfolio, which accounts for most of the reserves and is comprised of financial instruments on the international market and gold; 2) contributions to supranational entities, such as the International Monetary Fund (IMF) and the Latin American Reserve Fund (FLAR);[1] and 3) international agreements. One characteristic of the investment portfolio is that it is available for immediate use. Contributions to the IMF and FLAR allow Colombia to maintain access to their contingency credit lines. International agreements, such as the one signed with the Latin American Integration Association (ALADI), help to facilitate trade among the member countries.

1.2. General Objectives of Accumulating Foreign Reserves

Identifying the objectives of foreign reserves is essential to understanding *Banco de la República*'s reserve management policy. The Bank holds what it

1 Following the criteria established in the IMF Balance of Payments and International Investment Position Manual for calculating reserve assets, contributions to FLAR are excluded from the balance of international reserves reported to the IMF for statistical purposes. However, on *Banco de la República's* balance sheet and in the information provided in this report, contributions to FLAR continue to be part of the country's reserve assets.

deems to be an adequate amount of foreign reserves to intervene in the foreign exchange market and to facilitate access by the government and the private sector to international capital markets.

1.2.1 Foreign Exchange Intervention

Intervention in the foreign exchange market is one of the means *Banco de la República* has at its disposal to accomplish the fundamental objective of keeping the rate of inflation low and stable, as well as reaching levels of output that are close to its potential. For example, when rapid depreciation of the peso threatens the goal of meeting the inflation target, the Bank can mitigate exchange rate pressures by selling foreign currency on the market, thereby preventing the burden of the adjustment from falling solely on the interest rate. The Bank also can intervene in the foreign exchange market to control atypical or sudden movements in the exchange rate characterized by pronounced volatility in the foreign exchange rate and a sizeable increase in the spread between the currency's purchase and sale prices. Such movements may influence the performance of other financial assets linked to the foreign exchange market and can jeopardize the objective of proper functioning of internal and external payments.

Banco de la República does not intervene the market with a specific target for the exchange rate. As stated earlier, the main objectives of its intervention concern inflation, economic activity, and proper functioning of the foreign exchange market. Moreover, the Bank recognizes that intervention in the foreign exchange market is not always convenient or effective, which is why it is neither constant nor indiscriminate.

1.2.2 Access to International Capital Markets

Having sufficient foreign reserves facilitates access to international capital markets for both the government and the private sector. The level of foreign reserves is a determining factor in the perception of Colombian borrowers' payment capacity. Credit risk rating agencies and foreign lenders believe having an adequate level of reserves would allow Colombian residents to meet their obligations denominated in foreign currency, such as paying for imports and foreign-debt service, should the country find it difficult to access foreign funding. The fact that agents in the international capital markets use the payment capacity of the reserves as a measure of the country's liquidity highlights the importance of holding an adequate amount of foreign reserves.

Accordingly, *Banco de la República* seeks to maintain enough assets denominated in foreign currency to comply effectively with the aforementioned objectives. The amounts of foreign currency purchased are determined in such a way that *Banco de la República*'s external liquidity

is sufficient to cover the external deficit, foreign debt payments and other potential capital movements. Additionally, Colombia has access to the IMF Flexible Credit Line (FCL),[2] which operates as insurance that enables countries to deal with deterioration in external conditions. Like other central banks, *Banco de la República* places special emphasis on ensuring the safety and liquidity of its foreign reserve investments, without setting aside or ignoring the importance of generating returns on those reserves

1.3 Historical Developments in the Objectives of Accumulating Foreign Reserves

Prior to the 1990s, the primary objective of foreign reserves was to support foreign trade transactions. Therefore, the criterion for judging the sufficiency or adequacy of foreign reserves was the number of months of imports they could pay for. At that time, the foreign exchange policy was known as the "crawling peg" regime.[3] It was applied in a market that had very little exposure to foreign capital, due to the restrictive regulation that was in effect.

Law 9/1991 liberalized the foreign exchange market to stimulate foreign investment and facilitate international trade. The "crawling peg" regime (crawling peg devaluation) was replaced gradually for the exchange-rate band regime, and a free-floating exchange rate was introduced in 1999. With this new regulatory framework, the private sector increased its foreign borrowing, and syndicated loans—the traditional source of public-sector financing in international markets at the time—were replaced by bond issuance. The rise in capital flows made it more necessary than ever to maintain enough foreign reserves to protect the economy from a sudden reversal of those flows.

On the other hand, the 1990s saw several emerging market economies with solid fundamentals forced to confront capital outflows, due to the contagion effect caused by the crisis in Mexico, the Southeastern Asian countries and Russia. This fact proved that countries with prudent fiscal and monetary policies can also face circumstances of this type, further reinforcing the need to hold an adequate number of foreign reserves, particularly in light of empirical evidence that showed countries with sufficient reserves were less vulnerable to that contagion.

---

2 The FCL is an instrument created by this multilateral organization to support member countries that have strong economic fundamentals, prudent policies and a sound institutional framework for economic policy. Colombia's application for FCL access was approved for the first time in May 2009 and has been renewed on several occasions. The FCL in effect at the close of 2020 came to 12,267 m special drawing rights (approximately USD 17,600 m) and was renewed for two years on May 1, 2020.

3 As part of this policy, *Banco de la República* set the official exchange rate daily, making small daily devaluations

As a result of those events, the credit rating agencies began to assign more importance to the extent of a country's foreign reserves when defining the ratings for emerging market economies, since reserves are a measure of the capacity of the government and the private sector to meet their obligations in foreign currency.

The global financial crisis in 2008-2009, the drop in commodity prices during 2014 and 2015, and the slowdown in economic activity worldwide due to the Covid-19 pandemic confirmed the importance of having a sufficient amount of foreign reserves. In this context, it again became evident that countries with high levels of reserves have been able to deal more adequately with the vulnerabilities to which they have been exposed due to global distortions associated with capital flight, increased uncertainty, declining exports, systemic risk, and other situations arising from crisis environments.

1.4 How the Objectives of Accumulating Foreign Reserves Affect their Management

In keeping with the reasons for accumulating foreign reserves, it is possible to identify four main characteristics of the policy *Banco de la República* uses to manage them:

- To ensure compliance with the country's foreign payment obligations, reserves are invested in extremely safe and liquid financial assets for which there is a broad secondary market.
- The likelihood and the amount of intervention in the foreign exchange market are less with a floating exchange rate regime. As a result, the percentage of foreign reserves set aside to cover immediate liquidity needs, which is referred to as working capital (invested in the very short-term), is maintained at low levels.
- Since the need for liquidity is less under the current foreign exchange rate regime, the rest of the investment portfolio has longer maturities and higher expected returns, although the risk level is kept low. Reserve management policies are based on the modern portfolio theory, which recommends applying the principle of diversification: in other words, "don't put all your eggs in one basket," since it is impossible to predict with certainty how each investment in a portfolio will perform. Therefore, portfolio safety, liquidity and profitability are assessed as a whole and not according to the performance of individual investments.
- *Banco de la República* has a highly specialized staff and technology to manage the risks associated with foreign reserve investments. It also has the support of top-level foreign firms in this respect.

These investment policies are not exclusive to *Banco de la República*. In fact, they are consistent with the trend followed by most central banks throughout the world.

02 Institutional Framework

2.1 Legal Framework

The Colombian Constitution, [4] Law 31/1992 and Decree 2520/1993 (the Statutes of *Banco de la República*) set forth the rules *Banco de la República* must follow when fulfilling its functions, one of which is to manage the country's foreign reserves.

Law 31/1992, Chapter IV, on the management of foreign reserves and authority over international matters, states in Article 14: "*Banco de la República* shall manage foreign reserves in accordance with the interests of the public, to the benefit of the nation's economy and to facilitate the payments the country needs to make abroad. This includes the management, investment, deposit in custody, and disposal of foreign exchange reserves." Law 31 also determines "These shall be invested in assets denominated in freely–convertible reserve currencies or in gold, pursuant to the criteria of safety, liquidity and profitability."

Banco de la República's Board of Directors (BDBR) is the body authorized to "order contributions from the foreign reserves to international financial organisms, provided that such contributions also constitute reserve assets, [...] to carry out risk hedging transactions [and] to contract non-monetizable balance-of-payment credits." The Board of Directors is not authorized to make loans with foreign reserves, and the law states *Banco de la República's* foreign reserves shall be immune from seizure.

4 The Colombian Constitution adopted in 1991, Title XII (on the economic regime and public finance), Chapter 6 (on the central bank), Article 371.

Finally, Article 68 of the Statutes indicates: "The Bank may, in the performance of the international contracts it enters into and the main object of which is related to business or operations of an economic or financial nature, submit to foreign law or foreign courts, establish its domicile abroad or appoint agents abroad." In keeping with this provision, Sub-paragraph d of Article 1 in Internal Resolution 2 (The General Contracting Regime of *Banco de la República*), issued by the Board of Directors in 2010 with respect to the scope of its application, establishes that agreements "related to the management, custody, administration, investment, disposal and other activities concerning foreign reserves are excluded from said regime." [5]

2.2 Organizational Framework

2.2.1 Decision-making Bodies

At *Banco de la República*, the main decision-making bodies concerning the management of reserves are the Foreign Reserves Committee and the Foreign Reserves Operational Committee.[6] The former establishes the objectives, principles, and general policies for the management of reserves. It meets at least once every bimester and is chaired by the Governor of the Bank. Meetings of the Foreign Reserves Committee are attended by all full-time members of the Board of Directors and by the Minister of Finance and Public Credit (or his/her representative).

As part of its function to define reserve management policies, the Foreign Reserves Committee is responsible for setting investment guidelines and the benchmark. These tools define the criteria for the composition of the investment portfolio, the types of assets that are eligible, the operations that are authorized and the tolerable exposure to different risks. The investment policies established by this committee are set in accordance with the principles of the portfolio. In other words, the idea is to ensure all these investments meet the criteria of safety, liquidity, and profitability. These policies do not involve selecting individual investments; rather, they focus on defining criteria to ensure investments are made within a secure framework. Apart from outlining the criterion calling for the reserves portfolio to be invested at low risk, the investment policy also seeks to encourage an adequate return, since this criterion is part of the mandate given to *Banco de la República* by law.

The Foreign Reserves Operational Committee is responsible for monitoring and promoting efficient management of the operational risk posed to

5 Internal Resolution 2/2010, Article 2, stipulates: "Contracts entered into and carried out abroad may be subject to foreign regulations and courts."

6 In exercise of its legal and statutory powers, particularly those provided for in articles 14 and 15 and in Sub-paragraph ñ of Article 34 in the Statutes of *Banco de la República*, the BDBR issued Internal Resolution 6/2015 to replace Resolution 2/2001. It regulates the objectives, functions and responsibilities of the Foreign Reserves Committee and creates the Foreign Reserves Operational Committee.

foreign reserves. It usually meets at least once a month and its members include the Chief Officer for Payment Systems and Banking Operation, the Chief Officer for Monetary Operations and International Investments, and the Secretary of the Board of Directors.

The International Investment Department is part of the Office for Monetary Operations and International Investments and is responsible for implementing and monitoring the investment policies set by the Foreign Reserves Committee. The area within the International Investment Department that is responsible for the portfolio investments managed internally is the Sub-Directorate for Portfolio Management, while the Sub-Directorate for Risk Management is in charge of risk management, monitoring compliance with the investment guidelines, and the performance attribution of all investments. In addition, the department has three areas that provide support for reserve management. The Research and Analysis Team does economic and financial research and develops quantitative tools to support the process of investing foreign reserves and managing the risks this implies. The Information Development and Management Section helps to create and improve the technological tools used in the foreign reserve investment process and is responsible for efficient portfolio data management. The Sovereign Funds and Technical Support Section of the International Investment Department works with the Bank's legal departments to ensure the terms and conditions agreed in the contracts reflect financial market practices and match the technical conditions of the transactions.

2.2.2 Supervisory Bodies

Banco de la República has a broad and robust infrastructure to control investment portfolio management. It includes staff members from different areas within the Bank and from other institutions to ensure an impartial and independent process. According to the Colombian Constitution, control over *Banco de la República* is exercised by the President of Colombia, who is authorized under Law 31/1992 to delegate that function to the General Auditor's Office. As the President's representative, the General Auditor is responsible for certifying the Bank's financial statements; exercising control over its management and performance; ensuring its operations and transactions are consistent with legal prescriptions, respective decisions taken by the Board of Directors and the Office of the Governor, and the Bank's rules and regulations; seeing that measures are taken in a timely way to preserve and secure the Bank's assets and those it holds in custody or under any other heading; and ensuring the Bank's accounts are kept regularly and in accordance with the law and all applicable accounting standards. [7] The General Auditor also submits quarterly assessments to the President of Colombia, the Office of the Financial Superintendent of

7 Law 31/ 1992, Title IV (Inspection, Oversight and Supervision), Article 48.

Colombia and the BDBR on various operational and supervisory aspects of the Bank, including the management of foreign reserves.

On the other hand, "inspection and oversight of *Banco de la República*, faculties granted to the President under the Colombian Constitution, shall be exercised by the Banking Superintendent [now the Office of the Financial Superintendent of Colombia] [...] in accordance with Decree 239/1993".[8]

Banco de la República also hires an external auditing firm to issue an opinion on its financial statements, in accordance with international auditing standards. KPMG has been entrusted with this task since 2020. The involvement of an outside firm reflects the agreements all countries have with the IMF, in addition to acknowledging the importance international markets place on the verification of information related to foreign reserves. [9]

The Internal Control Department at *Banco de la República* was created under Law87/1993, which outlines the procedures governing internal control over public institutions. The department is responsible for independently verifying that the procedures necessary for the central bank to do its job in terms of investing foreign reserves are in place and are being observed fully.

In addition to the various supervisory bodies mentioned earlier, the Bank submits two annual reports to the Colombian Congress that include a chapter on the management policies, composition and return of the foreign reserves. This is done in the interest of transparency and pursuant to the provisions in Law 31/1992 (Article 5 therein).

Information on foreign reserves is also available in: 1) the Bank's financial statements published monthly on its website; 2) the reports submitted each month to the Office of the Financial Superintendent of Colombia, 3) the quarterly information sent to the General Accounting Office; and 4) the notes to the financial statements, which contain detailed information on the accounting policies applicable to the instruments that are part of foreign reserves, the composition of the portfolios managed directly and externally, and risk management policies, among others.

Additionally, in compliance with article 62, paragraph 2 of the Bank's by-laws, the Bank's financial statements on December 31 of the previous year are published in a newspaper with broad national circulation, and the composition of international reserves at the close of the same year is published on the Bank's website. Finally, the level of international reserves is published weekly on the Bank's website.

8 In this respect, see Article 70 in Decree 2520 /1993 and Article 47 in Law 31/ 1992.

9 The auditors' notes to the Bank's financial statements are available at http://www.banrep.gov.co/es/estados-financieros-anuales.

03

Organizational Structure for Foreign Reserve Management

As mentioned, there is an internal and an external infrastructure to manage the foreign reserves. Moreover, to maintain strict risk management practices at every stage of international reserves management, the functional areas are kept separate to minimize fraud, operational and legal risks, among others. A central aspect of the risk management framework at *Banco de la República*, and in many other central banks, is separation of the functions assigned to the so-called front, middle and back offices, as well as their separation from the internal supervisory, audit and accounting areas. This division of functions ensures the exposures assumed are within the limits established by the defined hierarchy and minimizes opportunities for fraud. The main elements of this risk management scheme are as follows:

- The Bank's *front office* is the Sub-Directorate for Portfolio Management of the International Investment Department, which is part of the Office for Monetary Operations and International Investments. It is responsible for planning and executing the operations of the portfolios managed internally, pursuant to the policies and guidelines defined by the Foreign Reserves Committee. The front office has a team of eight staff members.
- The duties of the back office, in terms of foreign reserve management, are performed by the Booking and Control of International Settlements Department (DRCPI for the Spanish acronym). It is part of the Office

for Payment Systems and Banking Operation and is responsible for confirmation, settlement and reconciliation of the operations carried out during the investment process, including the operational aspects related to custodians,[10] counterparties, correspondent banks and external managers.[11] The DRCPI also assesses the value of the portfolios and registers all operations on the books. It has a staff of 22 employees.

Consequently, there is a complete separation between those who execute financial transactions and those who are responsible for their registration, confirmation, and reconciliation. Furthermore, the International Investment Department, as part of the Office for Monetary Operations and International Investments, belongs to the Office of the Deputy Technical Governor, while the DRCPI, as part of the Office for Payment Systems and Banking Operation, belongs to the Office of the Deputy Executive Governor. This division of roles for carrying out and registering operations helps to reduce the risk of fraud.

Moreover, in the last few years *Banco de la República* has been working to consolidate a comprehensive risk management model aimed at strengthening the framework for risk management with respect to the institution's processes. In keeping with this objective, the Risk Committee was created to advise the Board of Directors on the Comprehensive Risk Management System. Likewise, the Office for Risk Management (an area that reports to the Bank's Executive Management) was assigned the role of acting transversally as a second line of defense (middle office), administering the Comprehensive Risk Management System (SGIR)[12] and monitoring, independently, from the first line of defense,[13] the management of risks inherent in the Bank's activities.

Comprehensive risk management at the Bank includes all mission and corporate processes and extends across the different types of risk. It is supported by risk management subsystems. The different risk management subsystems may have individual policies that provide guidelines regarding the particular management of risks within a process or type of risk according to their scope; however, they must be aligned and consistent with the transverse risk management policy approved by the Risk Committee. In this sense, the Office for Risk Management performs the functions under its

10 The custodians are the financial institutions where the Bank's securities are deposited. The Federal Reserve Bank of New York, Euroclear Bank, JP Morgan Chase Bank and State Street Bank are the main custodians of the country's international reserves.

11 *Banco de la República* engages firms to manage a portion of the country's reserves. A detailed description of the external management program is provided in Chapter 6.

12 The SGIR is defined as the set of policies, limits, methodologies and monitoring and control schemes established by *Banco de la República* to manage the organization's risks and support its decision-making process.

13 Refers to the business units leading the process.

responsibility with the departments and units that comprise it and with other areas of the Bank in different organizational units that perform second line of defense functions for specific processes, as is the case of the Risk Management Sub-directorate in the international reserve management process.

- The Sub-directorate for Risk Management of the International Investment Department is part of the Monetary Operations and International Investments Office and is responsible for monitoring all the portfolios on a daily basis to verify the managers comply with the investment policies and guidelines established by the Reserves Committee. As a result of this monitoring, the Sub-directorate for Risk Management prepares financial and operational reports that are submitted to the Reserves Committee and the Operational Committee, respectively. In addition, the team analyzes the investment strategies implemented in the different portfolios and is responsible for managing the Financial Risk Management System (liquidity, market, credit and foreign exchange risk) for international reserves, in accordance with the policies established by the International Reserves Committee.

In line with the Comprehensive Risk Management Policy, risk management at *Banco de la República* is based on a three-lines-of-defense model that makes it possible to identify, manage and control risks within a system of checks and balances. In this sense, the separation of functions is not restricted to the back and front office areas. There is also a separation between those who execute transactions and manage financial exposures (front) and those who measure them (middle).

There are other departments within the Bank that also help to manage foreign reserves and, therefore, are part of the risk-management framework. The Accounting Department is responsible for independently generating the Bank's official accounting records, which contain the economic facts of the international reserve portfolios recorded by the DRCPI. The Foreign Exchange and International Settlements Department manages the SWIFT system (Society for Worldwide Interbank Financial Telecommunication), which allows for a secure exchange of messages between financial institutions around the world. Access to this system is restricted. The International Investments Department and the DRCPI have access to SWIFT with different profiles; this allows different areas to capture, verify and release payment messages, which, among other operational controls throughout the process, helps to mitigate the risk of fraud. The Internal Control Department, which acts as the third line of defense, reports directly to the Office of the Deputy Executive Director. It guarantees the effectiveness of process controls, makes sure that all procedures are duly documented and executed in accordance with internal regulations, and suggests opportunities for improvement as well, so they can be carried out with maximum security. The manuals on processes and procedures

are published on the Bank's intranet and are defined pursuant to the guidelines in the Bank's process-based management model administered by the Office for Risk Management. These are updated frequently, serve as a tool for training new staff members and clearly define the powers and responsibilities assigned to each area and position. Lastly, the Human Resources Department requires a job manual for each position, which clearly defines the responsibilities and attributes of each officer at the Bank. The hiring processes ensure that personnel joining the Bank meet the profile of the position to be filled.

The General Auditor, who acts as the fourth line of defense, attends the meetings of the Foreign Reserves Committee with voice but no vote. The Office of the General Auditor carries out frequent inspection visits to the International Investments Department and the DRCPI to analyze the control environment and to put forth recommendations to improve the security of their processes and procedures. It also visits custodians and external managers to verify their control mechanisms.

04

Management of Risks Associated with the Investment of Foreign Reserves

All investments imply some risk, even those traditionally considered to be the safest. For example, sovereign bonds issued by developed countries, which are deemed the safest assets in the market, are exposed to the risk that their prices change or countries default on their debt. Money held in a safe deposit box is also exposed to risks; for example, there is the risk of it being stolen or deteriorating. Gold commonly is associated with secure conditions, but sometimes its price drops sharply. Moreover, any investment decision is made in an environment of uncertainty, since it is impossible to predict exactly how investments will perform in the future. This means every investor faces different types of risk all the time.

The safety criterion applied to managing foreign reserves in Colombia implies adequately controlling the risk to which investments are exposed. To manage risks within acceptable parameters and levels, the Foreign Reserves Committee defines strict limits for exposure to each of the different risks that foreign reserves face. Additionally, there is an internal structure to monitor and manage risk, since investments that are considered safe may become risky at any moment, due to changes in the economic environment and/or the financial situation of each issuer.

The main risks to which a central bank generally is exposed in managing its foreign reserve portfolios and the way *Banco de la República* deals with those risks are explained in the following sections.

4.1 Liquidity Risk

Liquidity is one of the criteria defined by law for the investment of foreign reserves. In the case of central banks, it is the risk of not being able to convert reserve assets into cash quickly, when needed, and at low cost. Liquidity risk is a constant challenge to managers since liquidity conditions in the market can change at any moment.

Central banks minimize liquidity risk by investing in financial assets that can be liquidated easily on the secondary market, such as securities issued by the governments of industrialized countries (e.g., U.S. government bonds) or short-term assets. *Banco de la República* also has several policies designed to keep low liquidity risk on its investments. First, a high proportion of the investment portfolio must be in assets that fall within the category of high-quality liquid assets as defined by the Basel Committee on Banking Supervision. Likewise, each security must have a minimum issue size, according to its currency of denomination (e.g., above USD 300 m in the case of issues in USD), and purchases of more than 10% of the outstanding amount are not permitted.[14]

In addition to investing in highly liquid assets, central banks usually define investment tranches according to the objectives of liquidity and profitability. The shorter-term and more liquid investments are used to intervene in the foreign exchange market. Normally, the portion of foreign reserves to be used only in exceptional cases is invested over a longer term to seek a higher rate of return. *Banco de la República* divides the foreign reserve investment portfolio into three tranches: short-term, medium-term and the gold tranche.

- The purpose of the short-term tranche is to cover the potential liquidity needs of foreign reserves in 12 months. This includes working capital, which is the portfolio into which funds from foreign exchange market intervention are placed, and its investments are concentrated in very short-term, dollar-denominated assets. Working capital is concentrated in deposits and investments that can be liquidated in one day at a very low cost. The remainder of the short-term tranche is invested in a larger number of instruments and has a term and expected return profile greater than that of working capital, while maintaining a high level of liquidity. The return in US dollars on this tranche is expected to be positive, with

14 These limits do not apply to money market assets.

a probability of 95% over a twelve-month horizon, and the expected value of a possible loss is expected not to exceed 1%. By December 2020, the value of the short-term tranche was USD 38,237.7 m (67.57 % of the investment portfolio), with USD 2,639.5 m corresponding to working capital.

- The medium-term tranche is executed at a longer investment horizon and with a higher expected return profile than the short-term tranche. Its objective is to maximize the risk-adjusted return in U.S. dollars (the currency in which the value of the country's foreign reserves is reported) for the portion of the portfolio that is considered less likely to be used within twelve months. The purpose of having a tranche with these features is to increase the expected return on foreign reserves in the long term, while maintaining a conservative portfolio. The anticipated return in U.S. dollars on this tranche is expected to be positive, with a probability of 95% over a three-year horizon, and the possible loss is expected to not exceed 1.0%. By December 2020, the medium-term tranche consisted largely of seven actively managed portfolios intended to generate a higher return than that of the benchmark. This tranche also includes funds managed by the Bank for International Settlements (BIS), to which only central banks and multilateral entities have access. The purpose of these funds is to invest in assets appropriate for the world's international reserves, as part of a cooperative effort among different countries. In December 2020, this tranche also included an internally managed portfolio of U.S. agency mortgage-backed securities.[15] The value of the medium-term tranche at that time was USD 18,241.0 million, which represented 31.99% of the investment portfolio.
- The last tranche is comprised of foreign reserves invested in certified physical gold, which can be traded readily on international markets. Gold makes it possible to diversify the investment portfolio, since its price behaves differently from the prices of the securities in which the short and medium-term tranches are invested.[16] The market value of the country's gold reserves in December 2020 was USD 252.22 m or 0.44% of the investment portfolio. Gold accounts for a small share of Colombia's foreign reserves, since its price tends to be highly volatile.

15 In the United States these are known as government sponsored enterprises (GSE). They are privately held agencies established to provide public financial services to reduce the cost of borrowing for certain sectors of the economy. The best known are Fannie Mae and Freddie Mac. They finance mortgages and were taken over and capitalized by the US government in 2008.

16 The correlation between the price of gold and the price of securities issued by national governments is approximately 0.15, which indicates their variations tend to be different.

In addition, the Bank monitors liquidity risk indicators that allow it to measure the time and cost of portfolio liquidation (these indicators are described in more detail in Box 1 of this report).

4.2 Market Risk (or Interest Rate Risk)

In the case of investments of foreign reserves, market risk materializes when the prices of the investments drop. As for fixed income instruments, which account for most of Colombia's reserve investments, their prices decline when interest rates on the world's major financial markets rise. This happens because these instruments pay a fixed rate of interest, which becomes less competitive when market rates increase. In contrast, when international interest rates fall, these reserves gain value.

To limit market risk in the investment tranche, *Banco de la República* invests in instruments that, on average, are not especially sensitive to interest rate hikes. It also monitors market risk through methods that are recognized in finance theory, such as duration, value at risk (VAR), conditional value at risk (CVaR) and stress tests, all of which help to measure the volatility of the prices of financial assets and the volatility of the portfolio as a whole. Duration is defined as the percentage change in the value of the portfolio due to a 1% variation in interest rates. For example, if interest rates increase 1%, a portfolio with a duration of 2 will lose 2% of its value. A portfolio with a higher modified duration has a higher expected return in the long term, since the rate of return on long-term bonds is normally higher than the rate on short-term bonds. Nevertheless, market risk in the portfolio also increases as the modified duration becomes greater. On the other hand, VaR is a measure that is widely used internationally to estimate, with a given level of confidence, the maximum loss the portfolio could incur in different time horizons. The CVaR is a measure that complements the VaR because it provides the expected value of losses when these exceed the VaR. Finally, stress tests are estimates of portfolio return in extreme scenarios that were observed in the past or could occur in the future. All these measures are reviewed to detect changes in the level of risk under different market conditions.

4.3 Credit Risk

The portfolio is exposed to credit risk because of credit events such as: 1) deterioration in the creditworthiness of issuers/issues of investment assets, or 2) default (non-payment) by issuers. To limit that risk, the Bank decided portfolio losses caused by credit risk must be very low, even in

extreme scenarios. Specifically, the idea is that default situations in 1% of the worst scenarios must not exceed 1% of the value of the portfolio. [17]

The measures taken by the Bank to comply with this policy and, therefore, to control credit risk include defining a minimum permissible credit rating, in addition to setting limits per issuer. As a reference in this respect, *Banco de la República* uses the ratings assigned by Standard & Poor's, Fitch Ratings and Moody's Investors Service. In the scale used by these international agencies, the highest long-term rating is AAA (extremely strong capacity to pay), followed by AA (very strong capacity to pay) and A (strong capacity to pay). The lowest rating is D and pertains to issuers who have defaulted on their payments. It is thought the average investor can invest safely, in the long term, in debt securities with ratings above BBB-. These are called investment-grade securities. Currently, the Bank's guidelines indicate the minimum long-term credit rating for debt securities that are eligible for the reserve portfolio is A-; [18] that is, three levels above what most investors consider to be safe. The guidelines state an eligible issue must have at least two ratings and the lower of the two is used.

In addition, the Bank has defined maximum limits on concentration per issuer to ensure diversification and lessen the impact of a credit event. The methodology used to define these limits seeks to capture the main factors that determine the credit risk posed by an issuer: the risk of non-payment and the risk of a rating downgrade. It consists of defining the limits in such a way that each issuer contributes similarly to the credit risk of the portfolio. In this sense, the contribution to credit risk is given by two variables. The first is each issuer's contribution to the risk of non-payment and the second is each issuer's contribution to the risk of the credit rating being reduced to speculative grade. Information regarding the default risk and downgrade risk of a specific type of issuer can be found in the transition matrices generated by the rating agencies. These indicate the historical probability of migrating between different ratings over a one-year period;[19] i.e., experiencing increases or reductions in their rating.

The established limits imply investments are concentrated in bonds that are issued by governments of developed countries and have high credit ratings. Within strict limits, investments in debt of other high-

17 Statistically, this implies taking the average value of credit risk losses in 1% of the distribution.

18 The investment guidelines on active portfolio management allow investing in exchange traded funds (ETFs) of investment-grade corporate bonds. Therefore, the investments that make up these funds can have credit ratings within a range of AAA to BBB-.

19 The rating agencies also construct transition matrices for periods longer than one year.

quality issuers such as quasi-governments[20] and corporate issuers also are allowed, as are investments in mortgage-backed securities of U.S. agencies.

In addition, the Bank sets restrictions on the type of assets allowed and their characteristics. For example, it does not permit investments in jurisdictions with a weak regulatory framework or where money laundering and terrorist financing are not combatted adequately. Only issues with senior (non-subordinated) payment priority in the event of liquidation are acceptable, and the maximum aggregate exposure to issuers other than governments in the benchmark is 50% of the portfolio.

In addition to permanently monitoring changes in credit ratings and compliance with the limits for all issuers, the Bank monitors the maximum loss from default events the portfolio can incur in a one-year horizon, with a certain level of confidence.[21] The purpose of this is to ensure the total risk of the portfolio is within the stipulated limits.

Besides the credit risk incurred with issuers, there is also a risk with custodians, current account correspondents abroad and futures agents. It is derived from the cash balance deposited with these enterprises. To reduce this risk, there are limits on the balances in these accounts, and a minimum rating of A- is required.

4.4 Foreign Exchange-rate Risk

The level of foreign reserves is reported in U.S. dollars. Therefore, investments in euros, yen and other currencies are converted to U.S. dollars at the market exchange rates that are in effect at the time. This means the portfolio value expressed in dollars may decline if the currencies in which the investments are denominated depreciate against the U.S. dollar. This exposure to fluctuations in exchange rates is known as foreign exchange-rate risk.

Currency prices are highly volatile and often have no defined long-term trend. It is, therefore, very difficult to forecast their behavior reliably. *Banco de la República* and most of the world's central banks have currencies other than the U.S. dollar in the composition of their foreign reserves. Besides diversifying the portfolio, this also serves to cover the country's payments abroad. The impact of foreign exchange risk is

20 Quasi-governments are government-related issuers. Supra-nationals, agencies, and governments that issue debt in non-local currency are included in this group, as are local authorities (e.g., states and provinces).

21 In this case, the variable is quite like what is known in the literature as credit value at risk (or credit VaR). The main difference is that credit VaR calculates all possible returns related to a increase or downgrade in credit ratings, while the measure calculated in this case concentrates only on the subset related to events of default.

treated through the equity account "exchange adjustment" referred to in Decree 2520/1993, Article 62, Paragraph 4 (Statutes of *Banco de la República*), which increases in years when reserve currencies strengthen against the Colombian peso and decreases in years when they weaken against the peso. Accordingly, currency variations have no impact on the comprehensive income statement.

To invest reserves with a high degree of safety and liquidity, investments are allowed in several currencies; namely, U.S. dollars, Canadian dollars, Australian dollars, New Zealand dollars, Hong Kong dollars, Singapore dollars, Swedish and Norwegian kronor, the pound sterling, Swiss francs, euros, yen, renminbi and the Korean won. All these currencies have large public debt markets, are highly traded internationally, and are currencies of countries with credit ratings that meet *Banco de la República*'s investment guidelines.

The currency composition of Colombia's foreign reserves is determined primarily by the definition of the benchmark. The Foreign Reserves Committee determines the weight of each currency within the benchmark and the maximum permitted deviations from that index. Chapter V explains the concept of the benchmark and what determines the currency composition of the different tranches in the portfolio.

At December 31, 2020, 87.77% of the investment portfolio was in U.S. dollars, 5.70% in Australian dollars, 3.16% in Canadian dollars, 0.59% in New Zealand dollars, 1.27% in Norwegian kroner, 0.63% in Korean wones and 0.87% in other currencies.

4.5 Counterparty Risk

Counterparty risk is the possibility of incurring losses related to a counterparty's default on a previously agreed purchase or sale transaction. This may occur for different reasons, such as operating errors or counterparty credit events. Accordingly, "payment-on-delivery" mechanisms are used to reduce counterparty exposure in fixed income transactions. The idea is to exchange securities for cash simultaneously to mitigate the impact of a default. When trading fixed income instruments, counterparties are also required to be market makers in one of the countries whose currency is eligible for foreign reserve portfolios.

In the case of foreign exchange trading, *Banco de la República* relies on continuous linked settlement (CLS), which is internationally the most widely used payment-on-delivery mechanism for foreign exchange settlement. Moreover, counterparties must have at least a credit rating of A- if there is

an ISDA agreement in place with them.[22] If not, the minimum rating is A+. In addition, foreign exchange transactions are performed at short terms, and limits on maximum exposure are set for each counterparty.

4.6 Operational Risk

Operational risk is the prospect of loss due to a failure involving internal processes, technology, infrastructure, people, or events originating with external sources or fraud.

To manage operational risk in a way that is consistent with the policies set for the Bank as a whole, the non-financial risk valuation methodology defined by the Office for Risk Management and approved by the Risk Committee is applied to the management of foreign reserves. It makes it possible to assess: 1) the risk inherent in the reserves management process; [23] 2) the mitigating effect of the controls; and 3) the level of exposure to residual risk.[24] In this methodology, the level of risk exposure is defined as the combination of the variables of probability and impact of a risk, to evaluate whether the controls are sufficient and adequate to mitigate the risks, and whether the level of exposure to such risks is in line with the risk tolerance defined for the Bank. If not, treatment plans are defined for managing them.

The Bank also has a crosswise scheme to control and manage operational risk events (OREs),[25] which are recorded in a database run by the Office for Risk Management. The purpose of recording these events is to be able to trace the materialization of risks within the Bank's processes, to define respective plans of action, and to follow up on how each of these events have been managed. The policy on authorizing expenses attributable to the materialization of risk events is approved by the Risk Committee and has levels of attribution in line with their materiality.

On the other hand, the Bank has a crosswise Business Continuity System that establishes technological strategies and operational contingency plans, which are reviewed and tested regularly. The objective of this system is to

22 The framework agreement established by the International Swaps and Derivatives Association (ISDA) is intended to set the terms and conditions governing over-the-counter derivatives traded between entities, including the procedures to be followed in the event of default.

23 Inherent risk corresponds to the assessment of risk without considering the effect of its controls.

24 Residual risk is what remains after applying the effect of the control environment.

25 OREs are incidents that represent the materialization of a risk or that warn of potential risks and that result in an entity incurring losses due to deficiencies, failures or inadequate functioning of processes, technology, infrastructure, or human resources, as well as the occurrence of external events associated with them. This includes the materialization of legal risk due to lawsuits, fines and/or penalties.

address, in a timely way, the possible impact of interruption events on the Bank's critical processes. The plan covers the foreign reserve management process.

4.7 Legal Risk

Exposure to contracts that are not legally enforceable or not documented properly, or to changes in legislation that affect the Bank's obligations is defined as legal risk. It is the responsibility of the Legal Foreign Affairs Unit, which is part of the Legal Department at *Banco de la República*, to review all contracts related to the management of foreign reserves. In doing so, it receives advice from law firms that specialize in international financial legislation. The Sovereign Wealth Funds and Technical Support Section of the International Investments Department is responsible for supporting the Legal Foreign Affairs Unit by ensuring that contract terms and conditions reflect financial market practices and are compatible with the technical conditions of the transactions.

4.8 Reputational Risk

There is the possibility that reputation and credibility in the management of foreign reserves might be questioned due to perceived mismanagement. To deal with this risk, the Bank has a solid infrastructure for the investment of foreign reserves and is transparent with respect to its management policies. The two annual reports to Congress, plus this report, which is published once every two years, also explain foreign reserve management and its results.

Box 1
Foreign Reserve Liquidity Indicators

Foreign reserves are managed according to three criteria: safety, liquidity, and return. Safety refers to adequate control of the risks to which the investments are exposed. Liquidity is the ability to convert invested resources into cash quickly and at low cost, while return is the capacity of financial assets to increase in value over time. This section describes the indicators used to monitor the liquidity of the international reserve investment portfolio.

The liquidity of financial markets can be measured through different dimensions:

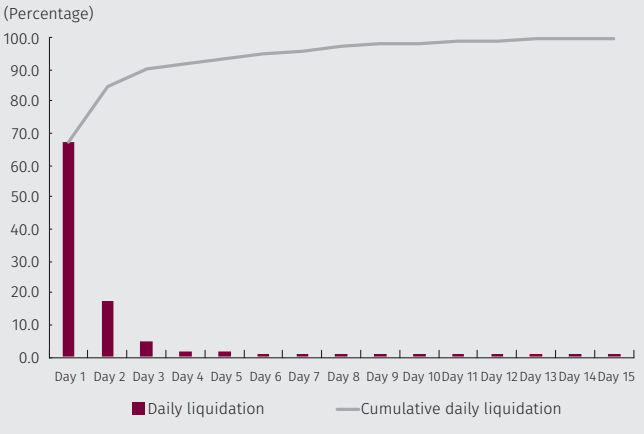
- **Tightness**: is defined as the difference between bid and ask prices; the smaller the difference, the more liquid the market.
- **Immediacy:** refers to the speed at which buy or sell orders are executed. The greater the speed, the better the liquidity of the market.
- **Depth:** refers to the existence of many buyers and sellers.
- **Breadth:** is the tendency of markets to remain unchanged despite the execution of large transactions.
- **Resilience:** is the capacity of the market to recover after stress scenarios or periods.

With these characteristics in mind, two types of indicators were defined to monitor the liquidity of the international reserve investment portfolio: 1) portfolio liquidation time, and 2) portfolio liquidation cost.

1. Portfolio Liquidation Time

The purpose of this indicator is to measure the number of days it would take to liquidate the portfolio, as well as the percentage of the portfolio that could be liquidated in a given number of days. Due to the extensive list of securities to which the portfolio is exposed, all the assets in the portfolio are grouped into different categories, according to the market [1] to which they belong and their maturity. The indicator is constructed for the different categories that have been defined.[2] It is based on an expert estimate[3] of the maximum amounts that could be sold daily without affecting market conditions. According to the category in which each security has been classified, as well as the maximum daily sale amount defined for that category and the amount of exposure to that security, the number of days required to sell the entire exposure is calculated. The results for each security are aggregated to obtain the results for each portfolio. According to Chart B1.1, the foreign reserve investment portfolio at the end of December 2020 could be liquidated, under normal conditions, in an estimated time of fifteen days. The percentage of the investment portfolio that can be sold each day and the accumulated percentage of sales up to that day is also shown. For example, 4% of the portfolio is sold on the third day, at which time 92% of the portfolio has been sold (72% on the first day, 16% on the second day and 4% on the third day).

Graph B1.1
Portfolio Liquidation Time



Source: *Banco de la República.*

2. Portfolio Liquidation Cost

The cost of liquidating the portfolio is calculated by adding the liquidation cost of each of the assets in the portfolio. This, in turn, is defined by the bid-ask spread on each security and the change in its valuation that may happen if it remains in the portfolio awaiting liquidation. The latter could occur if the entire exposure cannot be liquidated

1 (Box 1-1) For example, the classification by market may pertain to the type of sector to which the security belongs (government, corporate, quasi-government, etc.), and/or to the country (United States, Germany, United Kingdom, Japan, etc.).

2 (Box 1-2) Surveys are conducted with market experts such as trading counterparties, external managers and trading professionals of internally managed portfolios.

3 (Box 1-3) The information defined for each category will not necessarily reflect the performance of each of the securities, since it is a portrayal of the average characteristics of the group of issuers it represents.

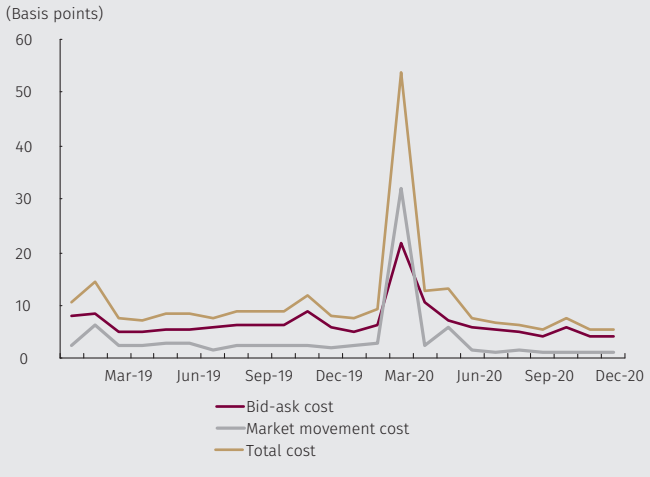
in a single day and the portfolio were to be exposed to unfavorable movement in the market price of that position. The following mathematical expression shows the different elements included in the liquidation cost indicator:

$$Liquidation\ cost = \sum_{i=1}^{N}\sum_{t=1}^{T} s_i * \alpha_{it} + (\alpha_{it} * \sigma_i * \sqrt{t})$$

where i is each issue in the portfolio, N is the number of issues, T is the total time to liquidate each issue, s_i is the bid-ask spread on the issue, α_{it} is the amount sold on day t of issue i, t is the day the issue is sold and σ_i is the daily volatility of the price of each issue. The parameters s_i and σ_i are obtained from the market information on each security that is available for the dates on which the indicator is calculated. Parameter α_{it} is calculated based on the maximum daily sale amount applicable to each security, as explained in the liquidation time indicator.

Accordingly, the defined cost function makes it possible to evaluate periodically the liquidity of the investment portfolio in two dimensions. The first is related to the spread between the purchase and sale of each issue, while the second is related to changes in the portfolio's liquidity due to increases in the volatility of each security because of movement in the market. The way market conditions affect the liquidity of the investment portfolio can be monitored as a result. Chart B1.2 shows how the liquidation cost evolved, in total and broken down by the bid-ask spread component, and the cost due to movement in the market. In it, one sees the onset of the Covid-19 pandemic, in March 2020, led the financial markets to times of stress, as reflected in their liquidity and, particularly, in the liquidation cost of the investment portfolio.

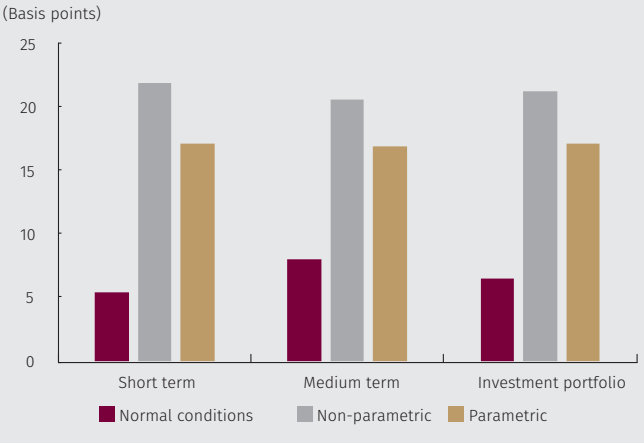
Graph B1.2
Portfolio Liquidation Cost



Source: *Banco de la República.*

The liquidity level of investments may vary according to market conditions. Therefore, it is important to examine both normal and extreme scenarios in an analysis of liquidity. To this extent, the Bank uses two methodologies to estimate the portfolio liquidation cost in a stress scenario. [4] The first assumes the bid-ask spread for each security is distributed normally, with mean and variance estimated based on the historical spread (parametric method). This method is used to find the bid-ask value that is one standard deviation above the mean of the distribution and would be equivalent to an extreme liquidation cost. With the second methodology, the 95th percentile of the historical bid-ask series for each security is obtained, without assuming any type of distribution (non-parametric method). Based on information at the end of December 2020, Chart B1.3 shows a comparison of the two measures used to simulate stress conditions with the liquidation cost under normal market conditions. As can be seen, the liquidation cost of the investment portfolio in a time of stress could increase more than twice the liquidation cost under normal market conditions.

Graph B1.3
Comparison of Liquidation Costs (Percentage of the Portfolio)



Source: *Banco de la República.*

In conclusion, the indicators used to monitor the liquidity of foreign reserve portfolios are as follows:

- Liquidation time
- Liquidation cost under normal conditions
- Liquidation cost under stress conditions (parametric)
- Liquidation cost under stress conditions (non-parametric)

4 (Box 1-4) A scenario is considered that demands total liquidation of the portfolio in one day and where, in turn, extreme values are observed in the bid-ask spread. So, the liquidation cost in the stress scenario does not incorporate the component associated with movements in price over time.

05

Benchmark and Portfolio Management

5.1 Definition

Most central banks manage their foreign reserves guided by a theoretical portfolio or benchmark. In capital markets, this concept refers to a basket of assets with predetermined weights, based on a number of rules defining its composition. Generally speaking, a benchmark tries to replicate broadly the performance of a market of financial assets and serves as an indicator of the behavior of other investment portfolios in that same market.[26] A good number of studies conclude that the benchmark chosen for a portfolio explains at least 90% of the return on that portfolio, making it the most important decision any investor can make.

Given that this is the main investment decision with respect to foreign reserves, the process to choose the benchmark is founded on the best international practices. The International Monetary Fund, in a document entitled *Revised Guidelines for Foreign Exchange Reserve Management,* recommends "Sound investment decisions should be consistent with the chosen strategy and not be dictated by the reporting and accounting framework." This means the strategy for investing foreign reserves must have an adequate investment horizon, based on an assessment of the sufficient level of reserves, the objectives for holding them and the risks to which they are exposed. Likewise,

26 For example, some of the best-known benchmarks in the market are the Colcap in Colombia, or the S&P500 and the Dow Jones in the United States.

when indicating that foreign reserve management should focus on portfolio performance as a whole, the International Monetary Fund states: "investment decisions regarding specific assets should not be dictated by accounting issues regarding that specific asset (e.g., the decision to sell or keep an asset in the portfolio should not depend on the outcome of the sale being an accounting gain)".[27]

These general principles are reflected in the process *Banco de la República* uses to define theoretical portfolios or benchmarks to manage the foreign reserve investment portfolio. Different benchmarks are constructed for the short and medium-term tranches to reflect different investment horizons. These benchmarks serve as a framework of reference to measure the way each portfolio is managed.

The concept of a benchmark does not apply to the working capital of foreign reserves since its purpose is to meet immediate liquidity needs. For this reason, it is denominated in US dollars.

5.2. Composition

Having decided to use benchmarks for the investment tranche, the Bank must define its composition in terms of currencies and types of instruments.

5.2.1 Currency Composition

There are several considerations when choosing the currency composition of foreign reserves. To begin with, if one of the main objectives of accumulating foreign reserves is to be able to intervene in the exchange market, the currency or currencies in the foreign reserve portfolio should be of considerable importance to that intervention. Given this objective, working capital is invested entirely in U.S. dollars, which is the currency that is used to intervene in the exchange market.

Secondly, if reserves are to be used at a particular time to fulfill obligations in foreign currency for trade of goods and services, as well as capital flows, the behavior of balance-of-payments outflows will have to be considered. Accordingly, *Banco de la República* looks at aspects such as the prices of imported goods and the currency composition of the external debt, both public and private. Because the short-term tranche is the first to be used to satisfy liquidity requirements in foreign currency, its currency composition seeks to replicate the behavior of balance-of-payments outflows, thereby providing coverage for Colombia's external payments. This allows the value of the short-term tranche to increase in periods when other currencies

27 "IMF Reserve Management Guidelines", https://www.imf.org/external/np/pp/eng/2013/020113.pdf, pg. 18.

strengthen against the U.S. dollar, compensating for the fact that both the value of imports and the value of the country's external debt in those currencies grow when measured in U.S. dollars. Although transactions are conducted with many countries, only currencies with a high daily volume of trading, large public debt markets and high credit ratings are chosen.

The following was the currency composition of the benchmark approved for the short-term tranche on December 31, 2020: 82% U.S. dollars, 9% Australian dollars, 5% Canadian dollars, 1% New Zealand dollars, 2% Norwegian kroner and 1% Korean wones. This methodology has been used successfully to cover balance-of-payments outflows, since the value of the currencies that are part of the exchange composition frequently behaves much like the country's payments in foreign currency, both in periods of increase and in those of decline.

With respect to the medium-term tranche, there is no restriction on currency composition because the objective is to maximize the risk-adjusted return in U.S. dollars, since this tranche is less likely to be used in the short term and U.S. dollars are the currency in which the level of reserves is reported. In the benchmark for this tranche, currencies other than the dollar are allowed if they help to fulfill the objective of the tranche. The benchmark portfolio for the medium-term tranche on 31 December 2021 was comprised entirely of U.S. dollars.

5.2.2 Eligible Instruments

The type and maturity of the instruments that are part of the benchmark portfolio will have to be defined once its currency composition has been decided. In this process, instruments are chosen that meet the conditions applicable to foreign reserves in terms of safety and liquidity. The only ones currently eligible for the benchmark index are the market's safest and most liquid assets; namely, securities of the governments of developed countries with high credit ratings and issuers that have the support of those governments. Gold is also included in this process as an eligible asset, to find its optimal share of the investment portfolio.

5.3 Construction

To construct a benchmark, the constraints on risk tolerance will have to be defined beforehand. Since there are many possible combinations of assets with different levels of risk, the constraints allow the selected benchmark to have a tolerable level of risk for the institution. In the case of *Banco de la República*, any admissible solution must be 95% or more likely to yield positive returns and have an expected loss in value of under 1%. These constraints are quite conservative, as they imply the expected return is positive most of the time and, in extreme cases, when it is negative, the

loss is contained. The following is an explanation of how the constraint for each tranche is constructed.

- In the case of the benchmark for the short-term tranche, a 12-month horizon is defined to comply with the constraints that call for positive returns with a 95% level of confidence and the expected value of a possible loss not exceeding 1%, since this tranche is the one most likely to be used in the short term. The foreign exchange effect is excluded of this tranche's constraints because the decision on currency composition aims for a volatility like that of balance-of-payments outlays and not for a higher return.
- For the medium-term tranche, the constraints with respect to having positive returns with a 95% level of confidence and the expected value of a possible loss not exceeding 1% are defined for a longer horizon (three years) to reflect the reduced probability of using the resources in this tranche and the search for a higher return. Since the base currency of the medium-term tranche is the U.S. dollar, the constraints consider the foreign exchange risk generated by currencies other than the dollar.

The portfolio construction methods applied to estimate the benchmarks are commonly used worldwide.[28] The following optimization process is used, based on the currency composition constraint for the short-term tranche, the set of eligible instruments and the constraints on risk tolerance:

- A set of portfolios or asset baskets that minimizes the risk posed to each expected level of return is constructed for each tranche.[29]
- The portfolio that maximizes the expected return for *Banco de la República* and complies with the risk-tolerance constraints is selected for each tranche.[30]

The portfolio construction methodology and the latest updates that have been applied to the process are explained in more detail in Box 2 of this report. The process results in two theoretical portfolios that are used as benchmarks. The eligible assets used in their construction include asset baskets that have been prepared by specialized entities. Used widely and recognized internationally, these indices have the advantage of being transparent, computable, replicable, and up to date. The desired share of gold in the investment portfolio is also obtained with this exercise.

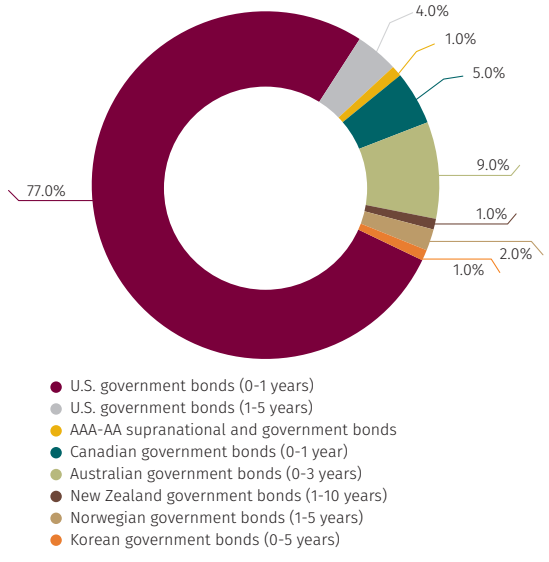
28 The main methodology now being used is known as the Black-Litterman model.

29 Known as the "efficient frontier".

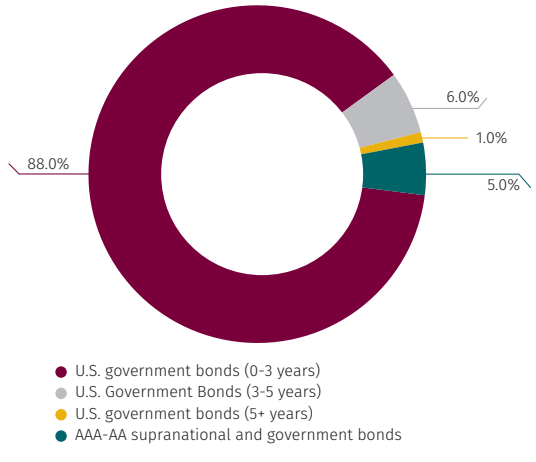
30 The utility function considers the return on the portfolio, its risk or volatility, and a parameter that measures *Banco de la República*'s risk aversion.

Graph 5.1
Benchmark Composition

A. Short-Term Tranche



B. Medium-term tranche



Source: *Banco de la República.*

The current benchmarks and their components are shown in Graph 5.1. A large portion of both benchmarks is in short-term U.S. bonds, which have low price volatility and are highly liquid. The modified duration of the two indices by 31 December 2020 was 0.81 for the short-term tranche and 1.78 for the medium-term tranche. This duration allows the portfolio to remain moderately sensitive to a hike in interest rates in the developed countries.

5.4 Passive and Active Management Mandates

The benchmark is a theoretical construction rather than a real portfolio. Consequently, policies for managing the portfolio based on that index will have to be defined. As mentioned earlier, considering the various reasons for holding foreign reserves, the most important components of the investment portfolio are the short and medium-term tranches, which have different benchmarks. There are two alternatives for managing the tranches against their benchmark: passive management and active management. These have different investment guidelines that set limits on the differences allowed with respect to the benchmark.

Passive management is intended to replicate the composition of the benchmark. The investments in this tranche are mainly securities issued by the entities that make up the benchmark. The passive portfolio was valued at USD 35,598.29 m (62.69% of the investment portfolio) on 31 December 2020 and is part of the short-term tranche.

- Active management looks for a higher return than the benchmark. To achieve this objective, the composition of the active portfolios may be different from that of the index. The managers of these portfolios apply their expertise and resources within a controlled-risk framework to determine strategies to increase the long-term return on foreign reserves. By the end of 2020, there were seven actively managed portfolios, totaling USD 17,354.63 m (30.51% of the investment portfolio). All the actively managed portfolios are part of the medium-term tranche.

- The Foreign Reserves Committee has decided that 30% to 35% of the portfolio is to be managed actively. This range allows for an adequate balance between the advantages of passive management (lower management costs and less risk in contrast to the benchmark) and the benefits of active management (higher expected returns and better portfolio diversification).

Actual returns on the Bank's foreign reserve investment portfolios are compared to the performance of the benchmark to determine if the portfolio managers have done their job successfully. In the case of passive management, the aim is for the portfolio to perform similarly to the benchmark. In contrast, the challenge for active management is to obtain a higher return than the benchmark, doing so in accordance with the investment guidelines defined by the Foreign Reserves Committee and a controlled risk budget.

5.5 Performance Measurement and Attribution

Reserve investment portfolio performance is measured through daily valuation at market prices (mark to market). A time-weighted daily rate of return is used to calculate the monthly returns.[31]

Performance is measured daily and reported to the Foreign Reserves Committee for horizons that range from monthly to year-to-date, full year and three years, using U.S. dollars as the base currency and without considering movement against the U.S. dollar by the currencies in which the reserves are invested.[32] This calculation is done for both the benchmark and the portfolios; therefore, absolute and relative returns can be measured against their respective index. The net returns are calculated from the gross returns by deducting the fees charged by the external managers.

31 The time-weighted daily rate of return calculates the daily change in the value of the portfolio, excluding portfolio withdrawals or additions. The return for any period is calculated via the geometric compounding of the daily returns. This is the methodology recommended by the CFA Institute, which is among the world's leading associations of investment professionals. One of its objectives is to publicize common standards used to measure portfolio performance.

32 Most private portfolio managers report their profits in the clients' local currency. Central banks, however, use a foreign currency (the US dollar or the euro): in most cases, it is the one used for intervention in the foreign exchange market.

An analysis of performance attribution is used to determine the most important factors that explain the absolute and relative returns on portfolios. This is done with a multifactorial risk model, which allows the return on individual securities, portfolios, mandates, and programs to be allocated by factors such as the movement in interest rates, in types of assets other than government bonds, and in currencies. It also permits an integrated analysis of returns and risk factors to determine the efficiency of investment strategies.

Box 2
Defining Benchmarks: Introducing Neutral Expectations to the Optimization Process

The process to optimize the strategic selection of assets for the foreign reserve portfolios is based on the Black-Litterman model, which consists of two phases to determine the expected returns on assets. The first involves finding the equilibrium returns implicit in market capitalization of the assets used in the optimization process (fixed-income bond indices) and the estimated covariance matrix, according to a CAPM model.[1] The second phase allows for incorporating expectations of return on these assets and obtaining a weighted average between the two sets of returns (equilibrium and expectations), in addition to including uncertainty about the expectations and the respective modification of the covariance matrix.

Within the framework of this methodology neutral expectations were incorporated into the process of optimizing the foreign reserve portfolios. These neutral expectations are based on information contained in the relevant financial markets (fixed income); i.e., they are the return expectations implicit in the asset prices at the time of optimization. The main reason for including them was the possible mismatch between the expected equilibrium returns that represent long-term performance, and the asset returns and short-term movements (more aligned with the investment horizon of the portfolios) that occur in the market. This allows the latest market data to influence the outcome of optimization.

1. The Black-Litterman Model

As mentioned, the Black-Litterman model has two phases. In the first, it is assumed the market portfolio is efficient (it is on the efficient frontier) and, therefore, knowing the covariance matrix and the market weights, by observing capitalization of the assets, it is possible to determine their equilibrium returns. These can be used for a new optimization that includes the investor's constraints (e.g., maximum probability of loss) when the investor has no expectations. This model assigns higher returns to riskier assets and lower returns to less risky assets, which is the long-term performance expected in an efficient market with rational agents.

The second Black-Litterman phase consists of defining and integrating the expectations of investors' returns with the equilibrium returns of the first phase. To start out, the expectations and their uncertainty are defined,[2] and then a new distribution of modified returns that includes the expectations is obtained.

The following expression shows the second phase of the Black-Litterman model.

$$N(\mu_{eq},\Sigma_{eq})+N(\mu_{exp},\Sigma_{exp}) \xrightarrow{Bayes} N(\mu_{mod},\Sigma_{mod}),$$

where the first term refers to the distribution with equilibrium returns (the first Black-Litterman phase), the second contains the information on the distribution of expectations, and the term on the right is the modified distribution obtained by applying Bayes' theorem. Finally, with the modified parameters, a new optimization is obtained, including the restrictions applicable to the investor. Diagram B2.1 shows the Black-Litterman model in summarized form.

2. Methodology to introduce Market Return Expectations in the optimization of the Foreign Reserves Portfolio

To introduce expectations into the optimization process (the second Black-Litterman phase), it was decided that neutral expectations, implicit in the markets, would be used since they would not introduce subjective biases.

As mentioned, the second Black-Litterman phase requires specifying two sets of parameters: the expected returns and the uncertainty about these expectations. The expected returns are calculated from the implied future spot interest rate curve or forward curve, which is obtained by means of non-arbitrage conditions with the information from the

1 (Box 2-1) Capital asset pricing model (CAPM).

2 (Box 2-2) It should be noted that it is not necessary to define expectations for all assets. So, for example, it is possible to introduce expectations for a single asset.

Diagram B2.1
The Two Steps of the Black-Litterman Model

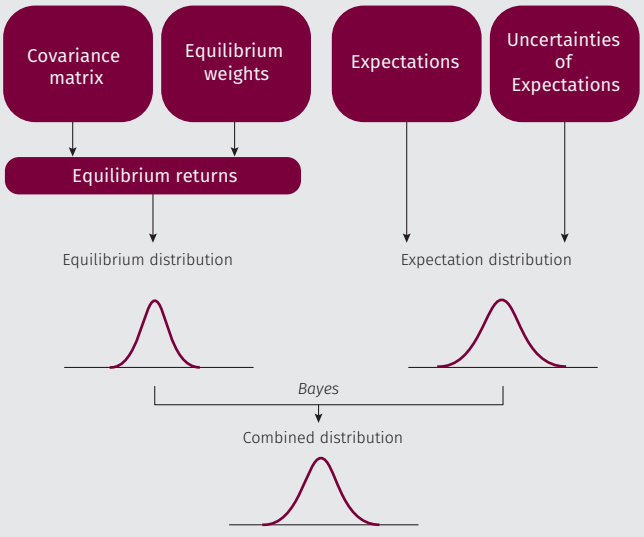


Diagram B2.1
The Two Steps of the Black-Litterman Model

interest rate curve (spot curve) and allows for calculating the components by price change (using the movement in rates between the current and future curves) and by interest (using the average of rates between the curves). To estimate the uncertainty of these forecasts, simulations of the interest rate curve are performed based on the distributions drawn from the interest rate options market. [3] Once the asset returns are calculated in each simulation, their standard deviations are calculated and used as the uncertainty parameter of the expected returns (Diagram B2.2).

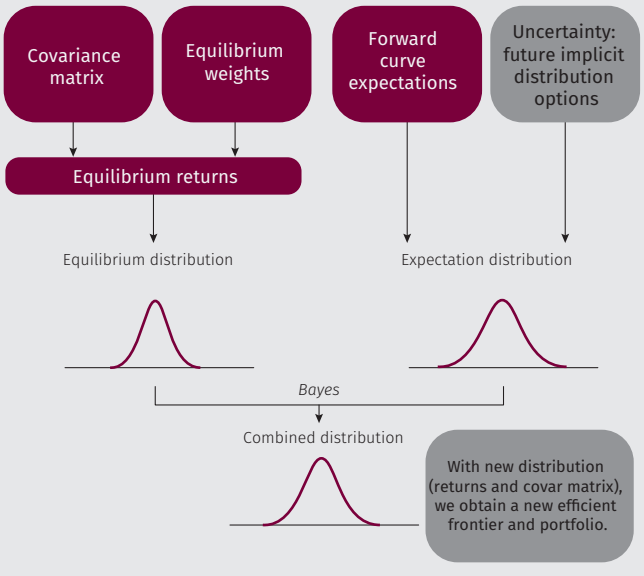
The steps required to find the two sets of parameters needed in the second phase of the Black-Litterman model are described below.

a. Calculating neutral (market) return expectations. Applying the non-arbitrage principle makes it possible to determine the fair rate between two future terms given the spot rates at those terms. The forward curve, which is interpreted as the implicit future spot curve in the horizon equivalent to the shorter term, is obtained by taking the shorter fixed term and varying the second. With these values, it is possible to calculate the vector of return expectations (μexp), which includes the effect of interest rate movements and the expected portfolio causation.

b. Calculating the uncertainties of return expectations. The following steps are required to estimate the uncertainties in return expectations:

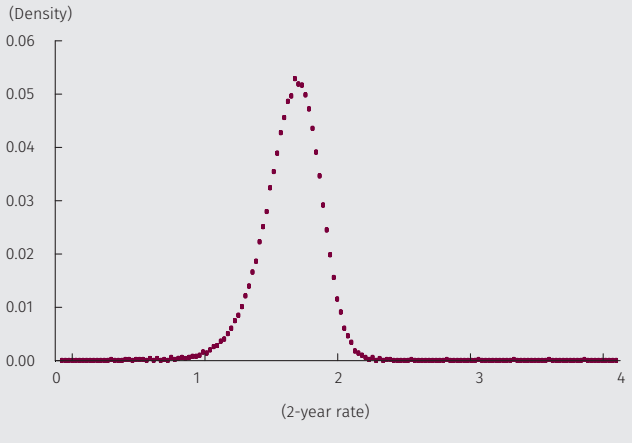
   i. Extraction of implied distributions in the options market. Ever since the work of Breeden-Litzenberg (1978), it has been known that the implied future distribution of an asset is proportional to the curvature of the option price as a function of the strike. Therefore, having a series of option prices for different strikes allows for estimating the future risk-neutral distribution. An example of the distribution found following this procedure is shown in Graph B2.1.

Diagram B2.2
The Two Phases of the Black-Litterman Model Applied to the International Reserves Optimization Exercise



Source: Adapted from "A Step-By-Step Guide to the Black-Litterman Model" by Idzorek (2005).

Graph B2.1
Future Probability Density 2-year Rate



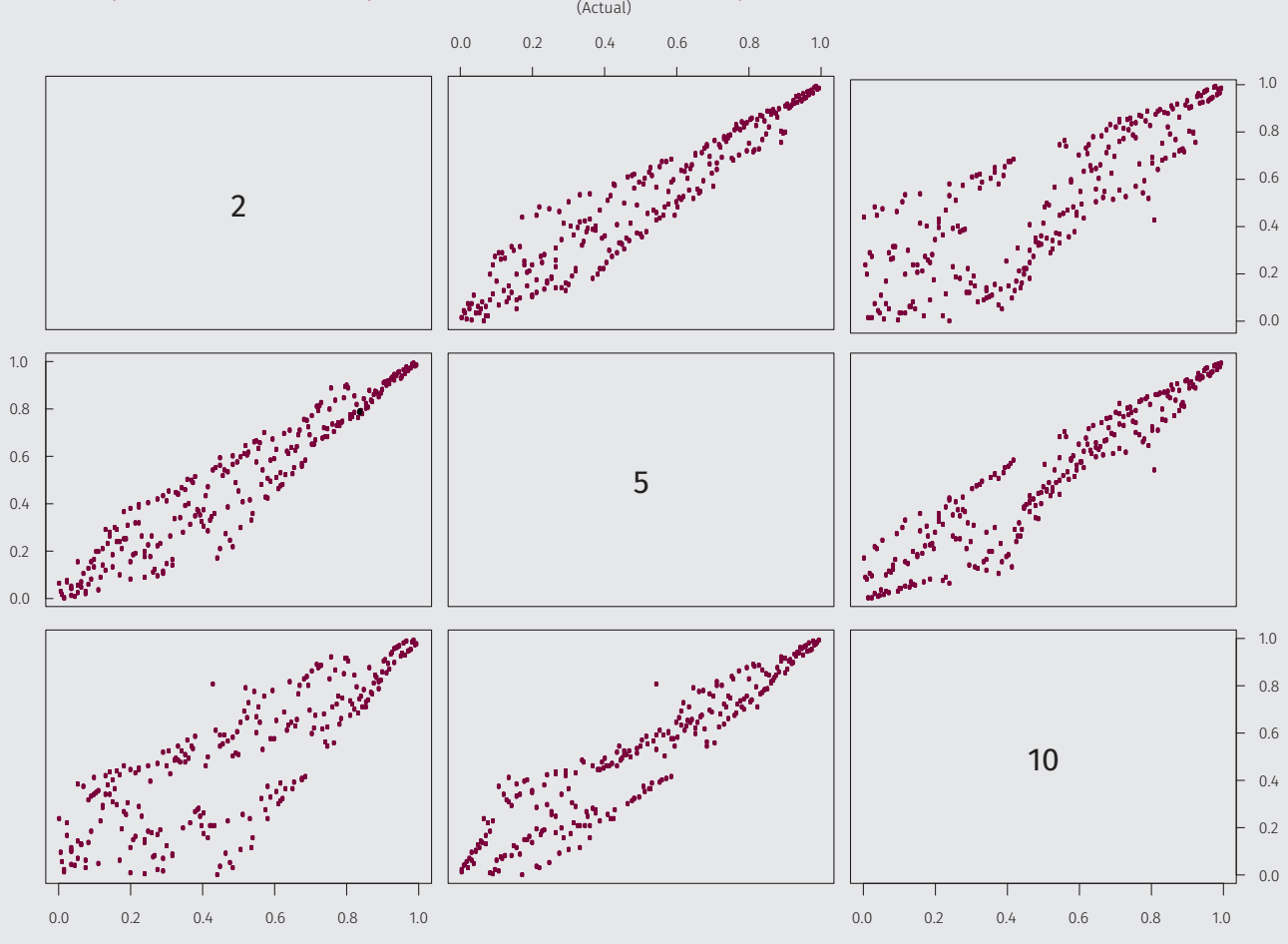
Source: Calculations by *Banco de la República*.

3 (Box 2-3) Since the most developed and liquid markets for interest rate derivatives are for U.S. rates, the forecasts are made on this market.

ii. Copula estimation between different interest rates in the U.S. government bond market. Historical data are taken, and a copula is fitted to the data (Graph B2.2). The copula is a function that generalizes the concept of correlation and, according to Sklar's theorem, exists under conditions that are not too restrictive on the behavior of the distributions of the associated random variables. This step is necessary since interest rates at different maturities in a single currency and of the same credit rating are highly correlated and simulating them independently is not recommended.
iii. Simulation of future interest rates and construction of the future spot curve. Simulations of interest rates are done with the copula of numeral *ii* and the distributions found in numeral *i*. Once the interest rates have been found, the term structure necessary to appraise the bonds is constructed.
iv. Valuation of assets with the new curves and estimation of returns. With the new curves, the returns for the price change component and for the causation component are found and added together.
v. Calculation of the standard deviations of the returns that define the covariance matrix used as an estimator of the uncertainty of expectations. (Σ_{exp}).

The neutral market expectations and their uncertainties are obtained with this procedure and are used to find the new parameters that feed the optimization exercise and the definition of the benchmark index: the vector of expected returns and the variance and covariance matrix of the assets. Using this model, one expects estimates of returns closer to observed values and portfolios more consistent with current market conditions.

Graph B2.2
(Actual)
Relationship between the cumulative probabilities [a/] for the two, five and 10-year rates at the end of the month since 2000.



a/ Cumulative probability distribution functions (pseudo-probabilities) are used since these are inputs for the copula and not the values of the interest rates.
Source: Calculations by *Banco de la República*.

06

External Management Program

The Sub-Directorate for Portfolio Management, which is part of the International Investments Department, manages the working capital, the passive portfolio of the short-term tranche, the gold tranche, and a portion of the medium-term tranche, which represents, in total, USD 40,848.9 m.[33] The external management program was adopted by the Foreign Reserves Committee in 1994 to manage all other resources.

The external managers are firms that specialize in investment portfolio management, and many central banks use them to manage their foreign reserves. They do so, in part, to improve the professionalism with which their portfolios are managed, but also because of the access to international market analysis the professionals of these entities can provide, as well as the training given to central bank staff members who are involved in foreign reserve management.

Because the external managers actively manage portfolios, they are authorized to invest in different assets and in proportions different from the benchmark, according to the investment policies and limits established by the Foreign Reserves Committee, which are known as *investment guidelines*. Contractually speaking, the external managers are responsible for any costs occasioned by deviations from the investment guidelines.

33 The internally managed non-indexed portfolio is managed similarly to those in the externally managed program, but with stricter limits. By the end of December 2020, a portfolio of agency mortgage-backed securities in the United States was also managed internally.

The Foreign Reserves Committee defines the parameters for assessing the external managers and monitors these indicators regularly.

External managers are hired to add value to the foreign reserve investment portfolio through more diversified investment. The firms that are selected are experienced and well versed in the world's financial markets, and have sophisticated infrastructure, all of which can be useful when defining strategies for investing foreign reserves. The assets managed by external firms are in custody accounts managed by *Banco de la República*, and the contracts with these managers may be terminated at any time by the Foreign Reserves Committee, should it decide to do so.

The external management program has generated the following benefits for *Banco de la República*:

- In the last ten years, the net return (after fees) on the external management program has exceeded its benchmark by 12 basis points (bps) per year, on average. In other words, the objective of adding value to foreign reserve management has been achieved with this strategy.
- Risk of deviation from the benchmark index is managed more efficiently by having diversified investment strategies with the different managers.
- The external managers have an analytical capacity that has enabled them to select investments with a good risk/return profile, consistent with what is permitted under the investment guidelines.
- The external managers have provided training to officers of the Bank, thereby contributing to the development of a qualified staff. This assistance also has improved the investment processes used by the International Investment Department and furthered its capacity for risk analysis.
- The International Investments Department receives information and analysis from professionals who are experts in the financial markets where the country's foreign reserves are invested. Moreover, the firms participating in the program have a sound group of credit analysts. This makes it possible to complement and expand the information on issuers provided by the credit rating agencies.

The external managers are allowed to deviate from the benchmark through interest-rate and foreign exchange-rate strategies. Interest-rate strategies consist of buying or selling bonds according to how interest rates are expected to behave, while foreign exchange-rate strategies call for the foreign exchange composition of the portfolio to be modified, depending on how currencies are expected to behave. The Bank monitors its externally managed portfolios daily to make sure the managers comply with the established limits.

JPMorgan Asset Management (UK) Limited, DWS International GmbH, Goldman Sachs Asset Management L.P., State Street Global Advisors Trust Co., UBS Asset Management (Americas) Inc. and Pacific Investment

Management Company LLC (Table 6.1). were the firms participating in the external management program with dedicated portfolios by December 31, 2020. The reason for having several external managers is for the program, as a whole, to outperform the benchmark and to do so with a low level of risk. This is possible through diversification.

Table 6.1
External Managers of the Foreign Reserves

Company	Amount Managed (Millions of U.S. Dollars)
DWS International GmbH	2,279.56
Goldman Sachs Asset Management L.P.	2,739.11
JPMorgan Asset Management (UK) Limited	3,195.36
Pacific Investment Management Company LLC	2,745.88
UBS Global Asset Management (Americas) Inc.	2,284.56
State Street Global Advisors Trust Co.	1,830.60
Total	15,075.16

Source: *Banco de la República*, December 2020.

The external managers with dedicated portfolios are assessed at the following stages:

- *Selection process*: External managers are chosen from among the top international firms specializing in fixed income portfolio management. The candidates must answer a request for proposal (RFP) that is intended to evaluate aspects such as the company's structure, organization, investment process, risk management, reporting, transfer of technology and training, and historical returns. The last stage of the selection process consists of a visit to the finalists. The ultimate decision is based on the fees quoted and the scores derived from the entire selection process. The Foreign Reserves Committee has decided the process for selecting external managers should be conducted at least every three years.
- *Regular assessment:* Once the management agreement takes effect, the Bank begins to monitor the manager closely, and reports on its performance are submitted to the Foreign Reserves Committee on a bimonthly basis, at the very least. Additionally, the Foreign Reserves Committee requires a thorough evaluation of the first three years' performance for each manager. This period was selected in an effort to have enough information for an appropriate evaluation. After the first three years, each manager is assessed, in detail, on a yearly basis. The criteria for this monitoring include returns, a review of the investment and risk-management process, and aspects concerning the firm's operation and service. Depending on the results of each manager's assessment, the Bank may decide to modify the delegated amount or cancel the agreement. Firms with the best annual assessments

manage the larger portfolios, depending on the amount of time they have worked with the Bank.

The Foreign Reserves Committee has decided to have seven actively managed portfolios. One of them is managed by the Bank's Sub-Directorate for Portfolio Management and the other six, by external managers. Both the number of managers and the share of the portfolio being managed actively are the result of consideration given to the following factors:

- Having only a few managers is not efficient. There is an important diversification benefit to be gained by having several active management portfolios since the unfavorable results of one manager can be offset by the favorable results of others. To the extent that there are more managers, diversification allows for less risk overall.
- Yet, having numerous managers is not efficient either. Working with many firms decreases the value of the assets managed by each of them, incurring higher costs for management fees.

In addition to the firms listed in Table 6.1, a small portion of the country's foreign reserves is invested in funds managed by the Bank for International Settlements (BIS), to which only central banks and multilateral agencies have access. Its purpose is to diversify foreign reserves through a cooperative effort among various countries. By December 31, 2020, these investments included the inflation-indexed securities fund (BIS Investment Pool Series ILF1: BISIP ILF1), which totaled USD 126.23 m; the fund invested in securities issued by the government and the Central Bank of the People's Republic of China (BIS Investment Pool: BISIP CNY), which amounted to USD 285.11 m; USD 115.13 m in the Korea Sovereign Debt Securities Fund (BIS Investment Pool: BISIP W), and the global corporate debt investment fund denominated in US dollars (BIS Investment Pool: BISIP Y), which came to USD 280.88 m. *Banco de la República* has been a member of the BIS since December 2011, and one of the objectives of this multilateral entity is to help central banks develop the capability to manage their foreign reserves.

07

The Current Status of Colombia's Foreign Reserves

The country's net foreign reserves [34] totaled USD 59,030.8 m by December 31, 2020. Graph 7.1 shows how Colombia's foreign reserves have evolved over the last 10 years.

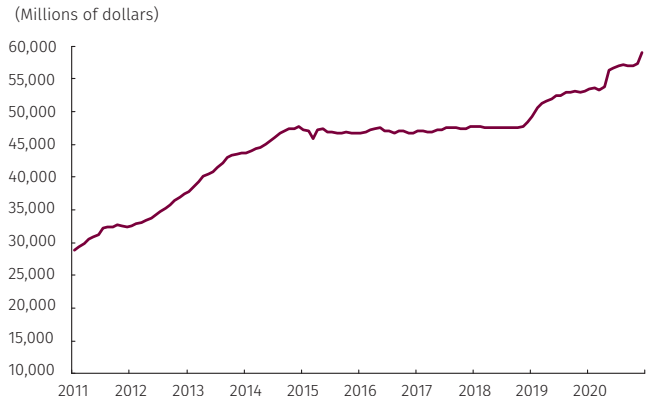
7.1 Indicators of Payment Capacity

Since foreign reserves help to protect the country from external shocks, which can come from the current account or the capital account, indicators of foreign reserves should focus on the variables that measure shocks of this type. Current-account shocks can originate with a drastic reduction in exports that makes it more difficult to pay for imports. Capital-account shocks are caused by difficulties in obtaining foreign financing, such as reduced access to international credit, or by increased capital outflows from both foreigners and residents.

The Bank's strategy for accumulating foreign reserves recognizes the importance of having enough international liquidity to deal with outflows of capital from the country, which could be provoked by factors such as a

34 The net reserves are equal to the total amount of foreign reserves (or gross reserves), less the Bank's short-term external liabilities. These are sight obligations in foreign currency with non-resident agents.

Graph 7.1
Colombia's Net Foreign Reserves



Source: *Banco de la República.*

deterioration in terms of trade, financial panic, or a financial crisis in neighboring countries. This being the case, having an adequate level of foreign reserves also helps to improve confidence in the country and, thus, to cope more successfully with a crisis in foreign markets. The methodology currently applied to determine the adequate level of external liquidity is described in Box 3: "New Methodology for Determining the Adequate Level of International Reserves," in the March 2019 edition of the *Report to Congress.* This methodology follows the liquidity coverage ratio (LCR) approach of the Basel III supervisory framework for commercial banks. It indicates that liquid assets should be sufficient to cover liquidity needs within a predetermined time frame, considering a stressed scenario.

Banco de la República's methodology stipulates that the foreign reserves must cover at least the projection of the current account deficit for the next twelve months, plus payments on the external debt. The foreign reserves by December 2020 were enough to cover these items. The same methodology also indicates the sum of foreign reserves and the FCL should cover the above items, plus possible capital outflows from residents and non-residents. By December 2020, the country's foreign reserves, plus the FCL net disbursement, were above this level.

A variety of external-vulnerability indicators are used to determine if a country has enough foreign reserves to prevent and combat external shocks. The main ones are the ratio of foreign reserves to monetary aggregates and the ratio of reserves to foreign-debt payments in the following 12 months, plus the current-account deficit. The objective in weighing reserves against monetary aggregates, such as M2 or M3, is to determine the economy's capacity to respond to capital outflows provoked by a speculative attack. On the other side, the ratio of reserves to short-term external debt, plus the current account deficit, indicates the country's capacity to respond to its credit obligations with the rest of the world in an extreme scenario where access to international financing is closed off entirely. Although the reserves-to-GDP indicator is used as a benchmark in some cases, it is less relevant because vulnerability to external shocks depends not so much on the size of the economy as on the country's trade and financial integration with the rest of the world. International markets generally regard low values for these indicators as possible warning signs of the external vulnerability of the economies being analyzed.

Table 7.1 shows several indicators of foreign reserves for the Colombian case. Also included is the reserve adequacy indicator calculated by the International Monetary Fund (IMF) for several countries, aggregating different sources of balance-of-payments risk into a single indicator.[35] The literature warns the likelihood of crisis is greater if the indicators of reserves to short-term debt are below one. In case of the IMF indicator, the recommendation is that it be between 1 and 1.5. According to these indicators, Colombia has an adequate level of reserves, as illustrated in the last rows in Table 7.1. Specifically, it shows the country currently has enough foreign reserves to cover, for more than one year, both short-term external debt payments and its current account deficit.

Table 7.1
Payment-Capacity Indicators of Foreign Reserves (FR)

	2016	2017	2018	2019	2020
FR/M3 (percentage)	31.5	29.8	31.1	32.0	32.7
FR/GDP (percentage)	16.5	15.2	14.3	16.3	21.5
FR in months of imports	9.9	9.9	8.9	9.7	13.2
FR/foreign debt service	1.7	1.3	1.2	1.5	1.6
FR/foreign debt amortization	1.6	1.6	1.4	1.5	1.6
FR/(foreign debt amortization + current account deficit)	1.1	1.2	1.1	1.1	1.2
FR/adequate level measure (IMF)	1.4	1.4	1.3	1.4	1.5

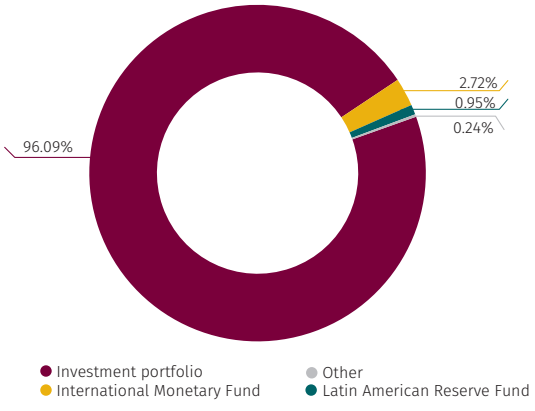
Sources: *Banco de la República* and the International Monetary Fund.

7.2 Composition of Foreign Reserves

Gross foreign reserves amounted to USD 59,039.33 m and short-term external liabilities, to USD 8.54 m. Net foreign reserves came to USD 59,030.8 m by December 31, 2020. The investment portfolio is the main component of the country's gross foreign reserves, accounting for 96.09 % of the total (USD 56.722.57 m). The remaining balance is distributed as follows: 1) the IMF quota and special drawing rights (SDR) (USD 1,605.05 m); 2) contributions

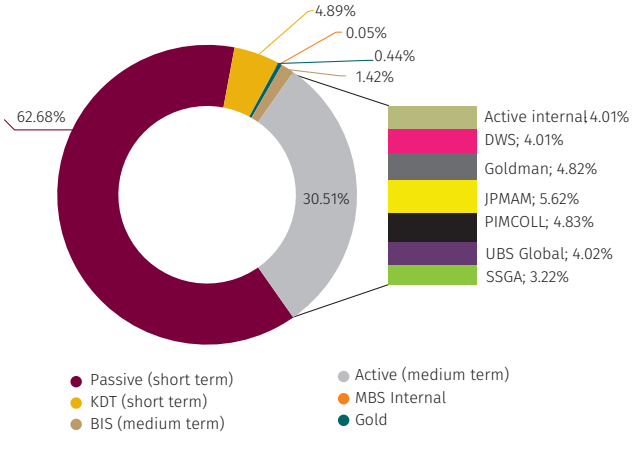
35 The IMF's adequate level-of-reserve indicator includes the following variables as sources of balance-of-payments vulnerability: exports, short-term debt, monetary aggregates and other portfolio liabilities. The IMF establishes standard weights for each of these variables, according to what is observed in different countries during periods of pressure on the exchange rate. The suggested weights for countries with fixed exchange rates are 30% of short-term debt, 20% of other portfolio obligations, 10% of M2 and 10% of exports. For countries with floating exchange rates, they are 30%, 15%, 5% and 5%, respectively. The IMF considers a country's level of foreign reserves to be adequate if it is between 1.0 and 1.5 of the estimated metric. The IMF document explaining this indicator can be found at: http://www.imf.org/external/np/pp/eng/2011/021411b.pdf

Graph 7.2
Composition of Gross Foreign Reserves



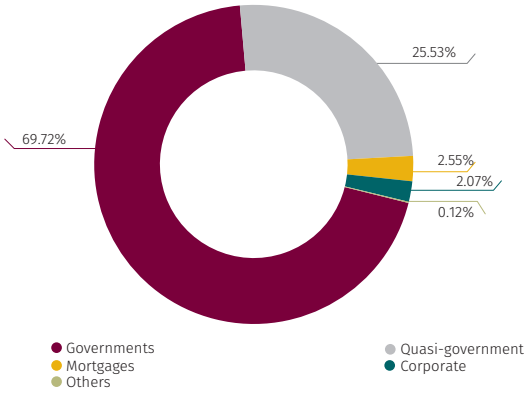
Source: *Banco de la República.*

Graph 7.3
Investment Portfolio Composition



Source: *Banco de la República.*

Graph 7.4
Investment Portfolio Composition by Sectors



Source: *Banco de la República.*

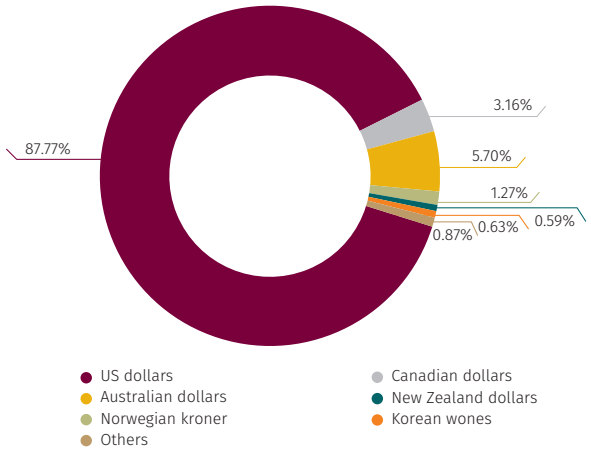
to FLAR (USD 559.00 m), and 3) others (USD 144.18 m).[36] The composition of the country's foreign reserves is shown in Graph 7.2.

7.3 Composition of the Foreign Reserve Investment Portfolio

Graph 7.3 shows the composition of the foreign reserve investment portfolio, detailing the portfolios managed internally and externally. The passive portfolio of the short-term tranche accounts for the largest share, while each of the medium-term tranche portfolios has a relatively small share.

Graph 7.4 shows the breakdown of the foreign reserve investment portfolio by sector. 97.8% of the portfolio is invested in securities issued by governments or government-related enterprises (quasi-government and mortgage agencies).[37]

Graph 7.5
Foreign Exchange Composition of the Investment Portfolio



Source: *Banco de la República.*

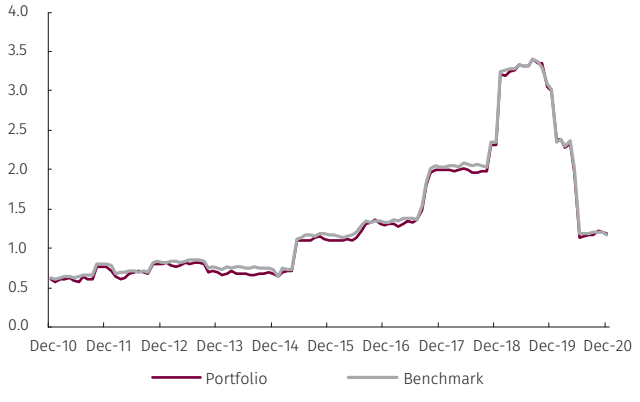
36 The item "others" includes cash on hand and sight deposits.

37 The securities in question are issued by government-backed or government-sponsored enterprises (e.g., Fannie Mae and Freddie Mac), supranational organizations (e.g., the World Bank and the Inter-American Development Bank) and local governments (e.g., cities and states), among others.

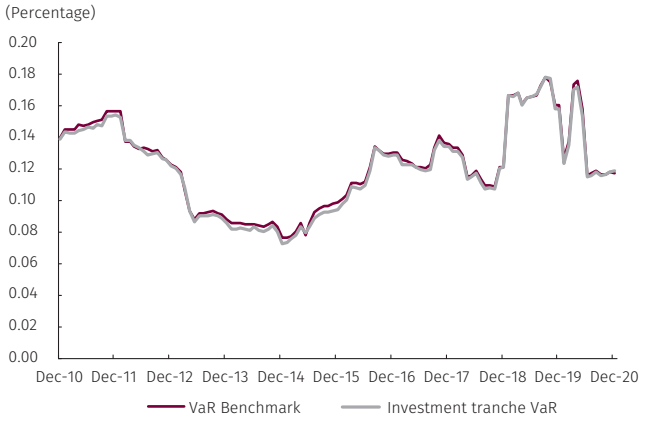
Graph 7.5 shows the foreign exchange composition of the investment portfolio. U.S. dollars account for 87.77% of the portfolio, while the remainder is invested in heavily traded currencies (Canadian, Australian, New Zealand, Hong Kong and Singapore dollars, the Swedish krona, the pound sterling, the Swiss franc, the euro, the yen, the Norwegian krone, the Chinese reminbi, and the South Korean won) from countries with high credit ratings.

Graph 7.6
Foreign Reserve Market-Risk Indicators

A. Duration of the investment portfolio and its benchmark



B. One-day value at risk of the investment portfolio and its benchmark, with 95% confidence



Source: *Banco de la República.*

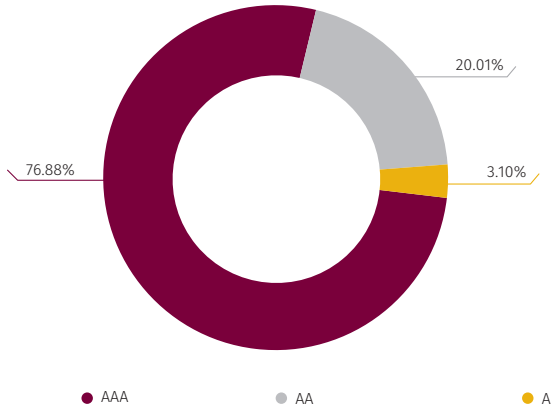
7.4 Main Indicators of Foreign Reserve Financial Risk

The duration of the investment portfolio at end of 2020 was 1.18,[38] which means 1.18% of the value of the reserves could be lost in response to an increase of 1.0% in the rates on all the bonds in the portfolio. Moreover, the value of the reserves is unlikely to lose more than 0.12% in one day (this measure is known in the financial literature as value at risk or one-day VaR, with a 95% level of confidence).[39] Both measurements are low, which suggests the foreign reserve portfolio has a moderate market risk or sensitivity to changes in prices. Graph 7.6 shows how both these measurements have evolved historically in terms of the benchmark, as well as the portfolio. The decline in the duration of the investment portfolio during 2019 and 2020 was due to a reduction in the duration of the benchmark for the short and medium-term tranches. The main factor explaining these changes is the decrease in short-term interest rates in the United States and other relevant markets for the portfolio, which are currently at levels close to zero. This decrease in interest rates has resulted in lower interest accruals and less capacity to assume market risk and to invest in assets that are more volatile.

38 The measure reported is the effective duration. It is calculated by finding the prices of all securities in the portfolio in response to a uniform change in interest rates. This is a more robust measure than modified duration because it allows for considering the performance of securities with embedded options.

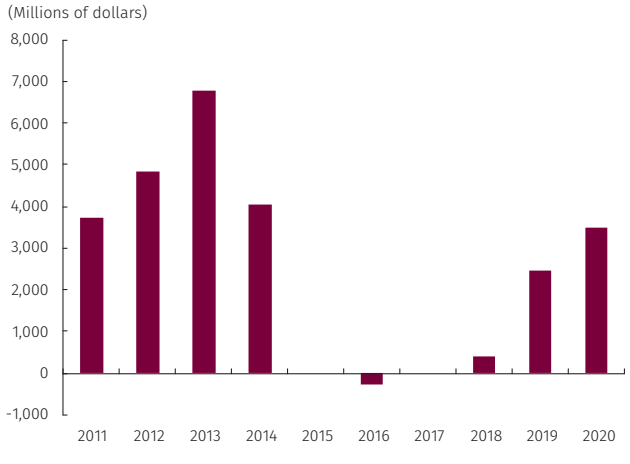
39 Value-at-risk (or VaR) is calculated by assuming market prices behave in line with their historical trend (statistically, returns on assets are presumed to follow a normal distribution). In extreme cases, namely, in instances not observed historically up to that point (e.g., the financial crisis in 2008), the percentage decline could be higher.

Graph 7.7
Distribution of Investments by Credit Rating



Source: *Banco de la República.*

Graph 7.8
Banco de la República's Intervention in the Foreign Exchange Market



Source: *Banco de la República.*

The good credit quality of the investment portfolio is illustrated in Graph 7.7. Most of the investments are AAA rated, since this is the rating on U.S. government issues. There is little risk of credit events occurring with these issuers, inasmuch as the historical figures show 0% probability of default in one year for sovereign issuers and regional-local authorities rated A- or above, while the probability is 0.02% for corporate issuers rated AA (including AA-), and 0.06% for those rated A+.[40]

7.5. Variation in Foreign Reserves

The level of international reserves in U.S. dollars changes largely due to three factors: intervention in the foreign exchange market, exchange rate variations and profitability. The behavior of each of these factors over the last ten years is described below.

7.5.1 Foreign Exchange-Market Intervention

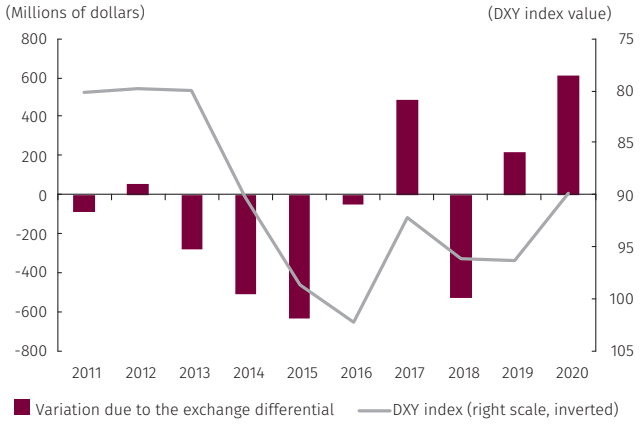
Graph 7.8 shows the Bank's intervention in the foreign exchange market. The positive values represent net purchases of reserves during the year, while the negative values represent net sales. Intervention has been the main factor behind the increase in foreign reserves during the last ten years.

7.5.2 Variation Due to the Foreign Exchange Differential

The country's foreign reserves are measured in U.S. dollars. Therefore, the value of reserve investments in other currencies is modified by changes in exchange rates. *Banco de la República* has set up an equity account for currency fluctuation; it increases in years when other currencies strengthen against the dollar and decreases when they weaken. This means the comprehensive income statement is not affected by fluctuations in exchange rates. As explained earlier, the decision on foreign exchange composition focuses primarily

40 According to reports by Moody´s Investor Service: Sub-sovereign Default and Recovery Rates, 1983-2020; Annual Default Study: Following a Sharp Rise in 2020, Corporate Defaults Will Drop in 2021.

Graph 7.9
Variation in Foreign Reserves in Dollars Due to the Exchange Rate Differential



Source: *Banco de la República* and Bloomberg.

on hedging the currency risk in the balance of payments, rather than on obtaining positive returns. Graph 7.9 shows variations in foreign reserves due to exchange rate changes and the US dollar index (DXY), which measures the behavior of the dollar against the main currencies of developed countries. The US dollar has appreciated in the last ten years, thereby reducing the U.S dollar value of investments of reserves in other currencies.

7.5.3 Return on Foreign Reserves

The profit the Bank obtains by managing foreign reserves is generated within a framework where safety is paramount. The decision to have a portfolio with a conservative risk profile implies receiving less return in the long run, as opposed to portfolios with more risk. According to the basic financial theory of portfolio management, investors who want less risk must expect fewer returns. The return on foreign reserves depends largely on two factors: interest accrual and securities valuation.

The interest-rate profit comes primarily from returns on the debt securities in which the reserves are invested. In turn, the return on valuation comes from changes in the prices of securities due to changes in interest rates. Debt securities can be sold prior to maturity, which is an important feature; however, interest rates are constantly changing in the market, while most securities pay a fixed interest rate. Therefore, a decline in market interest rates raises the price of debt securities, as they become relatively more attractive by having a higher fixed interest rate. The opposite occurs when market interest rates rise; in this case, the price of debt securities declines, since they become relatively less attractive due to their lower fixed interest rate. In the end, there is an inverse relationship between the price of a bond and the interest rate.[41]

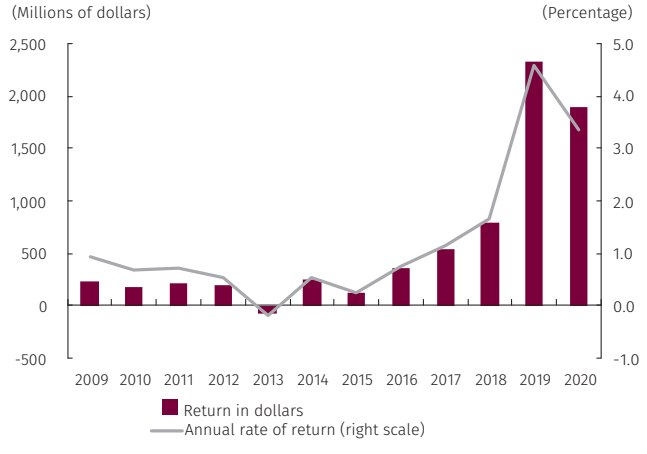
The central bank's monetary policy is the primary factor that determines the interest rate profit as well as changes in price. This is because it tends to move in the same direction all the interest rates on the instruments issued in a particular currency. In terms of the interest received for holding a debt security, the return is higher

41 The inverse relationship between the price of a bond and the interest rate also can be explained mathematically. The price of a fixed income instrument is defined as the present value of cash flows, discounted at a specific interest rate or rate of return, as shown in the following formula: $P = \frac{FC_1}{(1+i)} + \frac{FC_2}{(1+i)^2} + \cdots + \frac{FC_n}{(1+i)^n}$ where P = price of the instrument; FC = cash flow (coupons and principal); i = rate of return on the instrument; and n = number of periods.

when interest rates are up and lower when they are low. With respect to the prices of debt securities, they rise with a decline in interest rates and fall when interest rates increase.

Graph 7.10 shows the past performance of foreign reserves,[42] which adds the two components explained above: interest and valuation. Profitability between 2009 and 2015 was low but recovered as of 2016, both in dollars and rate. Profitability was down between 2009 and 2014 because the U.S. Federal Reserve decided to keep the U.S. benchmark interest rate (on federal funds) between 0 % and 0.25 % to stimulate the economy, which lowered interest accrual. As of 2015, the benchmark interest rate rose gradually to range of 2.25 % to 2.50 % in 2018. This slow rise in the interest rate increased interest accrual. During 2019 and 2020, the benchmark interest rate declined quickly, returning to a target range of 0 % and 0.25 % because of the exceptional measures taken by the authorities in the wake of the economic effects of the Covid-19 pandemic. This rapid decline in interest rates led to an increase in the value of the securities that make up the portfolios (appreciation factor) and, therefore, favored the profitability of international reserves during the last two years.

Graph 7.10
Historic Return on Foreign Reserves

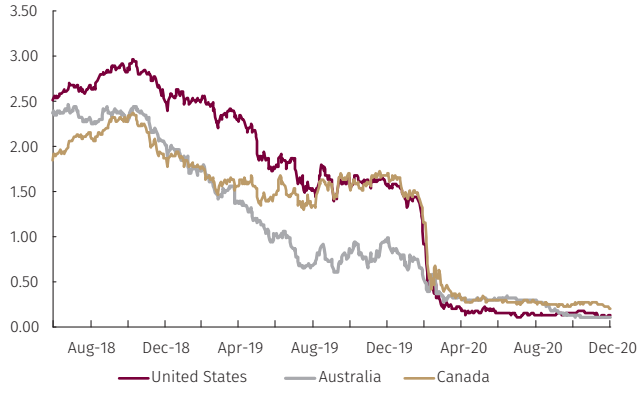


Source: *Banco de la República.*

Appreciation in the international reserves portfolio during 2019 and 2020, owing to the quick drop in interest rates, conceivably will have a negative effect on its profitability, which will remain low in the coming years. The decline in interest rates on the assets in the portfolio, and the respective increase in their prices, led to the reception of profits, in 2020, that were expected in a longer time period, under more stable conditions. On the other hand, the drastic reduction in interest earned on the assets in the portfolio will cause future profitability to decline. Moreover, the possibility of obtaining additional returns because of further cuts in interest rates seems less likely this time than in previous periods. As illustrated in Chart 7.11, interest rates in the relevant markets for the investment of foreign reserves are close to zero and, for the time being, are not expected to reach negative levels.

42 The annual rate of return is calculated by using the total return for each year in dollars, as reported by the Accounting Department, and finding the average between the value of net reserves on December 31 of the year in question and their value on the same date the year before.

Graph 7.11
Short-Term Government Bond Rates (2 Years)



Source: Bloomberg.

Finally, Table 7.2 shows the performance of the international reserve portfolios compared to their benchmark, by each type of mandate and for the aggregate. The returns include the effect of the variation in foreign exchange rates against the dollar. Passive management has generated returns similar to those of the benchmark in three and ten years, while active management returns have surpassed it.

Table 7.2
Portfolio and Benchmark Return Rates (Including the Exchange Rate Component)
(Percentage)

	Annualized portfolio returns in the last three years (2018-2020)				Annualized portfolio returns in the last ten years (2011-2020)			
	Portfolio	Benchmark	Gross excess return	Net excess return	Portfolio	Benchmark	Gross excess return	Net excess return
Aggregate portfolio [a/]	3.27	3.20	0.06	0.05	1.12	1.06	0.06	0.04
Passive portfolio	2.91	2.89	0.01	0.01	1.00	1.00	0.00	0.00
Active portfolio	3.90	3.69	0.21	0.15	1.25	1.06	0.19	0.12

a/ Includes portfolios of active and passive mandates.
Source: *Banco de la República.*