

## Box 2: Evolution of the Foreign Reserves Accumulation Program

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### Introduction

On 19 December 2023, the Board of Directors of *Banco de la República* (BDBR) announced the start of a Foreign Reserves (FRs) Accumulation Program for a maximum amount of USD 1,500 million (m)<sup>93</sup>. The purpose of this program is to ensure adequate levels of external liquidity and prepare for a potential gradual reduction in Colombia's access to the International Monetary Fund (IMF) Flexible Credit Line (FCL), as announced during the renewal of this instrument<sup>94</sup>. This decision also considered the uncertainty in the global context at that time.

The official statement accompanying this decision informed that *Banco de la República* (*Banrep*) would use put options<sup>95</sup> to accumulate FRs, with a monthly limit of up to USD 200 m. These options could only be exercised when the Representative Market Exchange Rate (TRM in Spanish) was below its average of the last 20 business days. This condition helps to prevent *Banrep* from making purchases in situations of upward pressure on the exchange rate. In addition, it was emphasized that the measure was not intended to influence the exchange rate or modify its level or volatility.

This analysis provides a review of the characteristics of FRs accumulation options and presents the preliminary results of the Foreign Reserves Accumulation Program for the first half of 2024. It highlights the progress in meeting the objectives that motivated its implementation.

In particular, it is noted that the accumulation of FRs has allowed them to remain at adequate levels, as reflected in the robustness of internationally used metrics, such as the IMF's Assessing Reserve Adequacy (ARA)<sup>96</sup>, implemented by *Banrep* to measure whether the level of FRs is sufficient to cover potential risks that justify its accumulation. This, in turn, constitutes a robust signal of the strength of the country's external position.

### Background and Characteristics of Reserves Accumulation Options

The objectives and instruments of intervention have been mainly related to achieving or maintaining an adequate level of FRs, containing strong pressures on the exchange rate, and moderating volatility in contexts where foreign exchange hedging markets were not sufficiently

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<sup>93</sup> <https://www.banrep.gov.co/en/news/jdbr-decided-program-accumulate-foreign-reserves>

<sup>94</sup> On April 26, 2024, the IMF approved a new two-year arrangement in favor of Colombia under the FCL for an amount in Special Drawing Rights (SDRs) of 6,133.5 m (300% of Colombia's quota to the organization), which is equivalent to about USD 8,100 m. This agreement replaced the previous one, approved in 2022, for an amount in SDRs of USD 7,155.7 m (corresponding to 350% of Colombia's quota) and is considered by the Colombian authorities as a precautionary instrument to face external risks.

<sup>95</sup> Derivatives are financial instruments that depend on the value of some other asset (e.g., futures, forwards, and options). A put option is a derivative financial contract that gives the buyer the right, but not the obligation, to sell an asset at a specific price, in this case foreign exchange, before a specified maturity date. In turn, the seller of the option acquires the obligation to buy the underlying asset at the agreed price, known as the strike price, if the option is executed by the buyer.

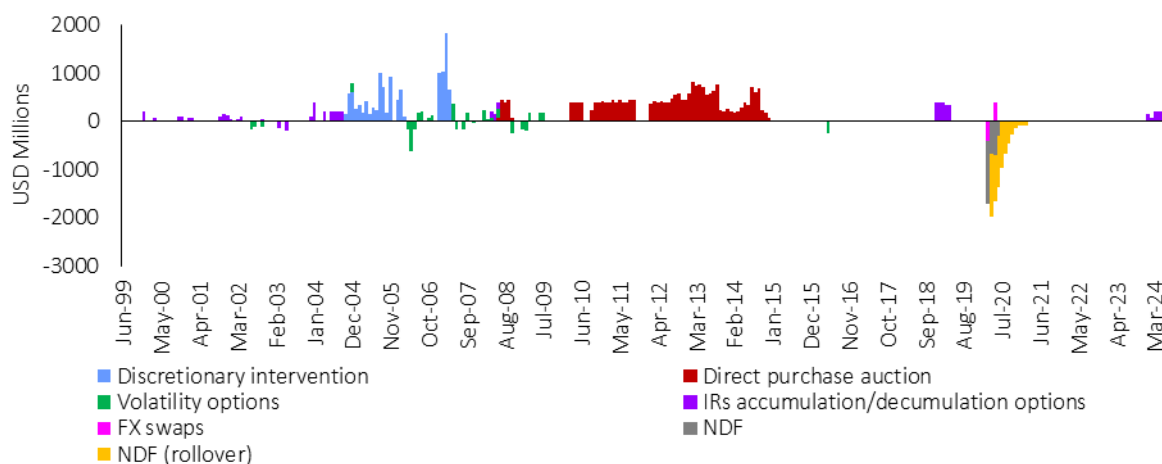
<sup>96</sup> See Moghadam *et al.*, (2011), IMF (2013) and IMF (2015).

**developed**<sup>97</sup>. In this regard, the main intervention modalities have included FRs accumulation and decumulation options, volatility options, discretionary foreign currency purchases in the market, and daily auctions for the purchase of fixed amounts of reserves.

**The FRs accumulation options were the first intervention instrument used by Banrep in the foreign exchange market, offered for the first time in December 1999 (Graph B2. 1).** At that time, they were used to bring FRs to adequate levels, after reductions experienced during the late 20th-century financial crisis, minimizing the impact on the exchange rate.

**Through this mechanism, approximately USD 5,234 m were accumulated between 1999 and 2019.** In particular, the instrument was used during the following periods: (i) from November 1999 to December 2002, (ii) from July 2003 to August 2004, (iii) from March to May 2008, and (iv) from September 2018 to April 2019. The auctions were suspended at times when the Colombian peso faced strong depreciation pressures and when it was considered that the desired level of reserves had been reached.

**Graph B2. 1 Progress of Banrep's Monthly Intervention in the Foreign Exchange Market (Net Purchases)**



**Source:** Banrep. **Note:** Further details of the characteristics of the other instruments for foreign exchange intervention can be found in the Regulatory Circular DOAM-143, corresponding to Subject 5: *Banco de la República's* intervention in the foreign exchange market.

**With this instrument, agents**<sup>98</sup> **can acquire contracts at a fixed premium through a uniform price auction**<sup>99</sup>, **granting them the right to sell dollars to Banrep during the auction month at the TRM in effect on the exercise date.** This right may be exercised at any time before the option expires, provided that the TRM is below its average of the last 20 business days<sup>100</sup>.

<sup>97</sup> For further details, see Cardozo, Vargas, and Villamizar (2019), Box5: Considerations for Intervention in the Foreign Exchange Market by *Banco de la República* ([link](#)), and Rincón, H. *et al.* (2020).

<sup>98</sup> The agents that can participate in these options are the Foreign Exchange Options Intermediaries (FOIs), formed by the Foreign Exchange Market Intermediaries (FXIs), referred to in numerals 1 and 3 of Article 8. of the External Resolution 1 of 2018 of the Board of Directors of *BanRep*, and the Ministry of Finance and Public Credit.

<sup>99</sup> In this mechanism, participants can submit one or several bids, and approved bids will pay the same price or cut-off rate. Each agent can submit up to 5 bids for a total amount that does not exceed the auction quota, and the ratio between the maximum premium and the minimum premium submitted by the same agent cannot exceed 3. If any of these limits are exceeded, the bid(s) with the lowest premium will be annulled.

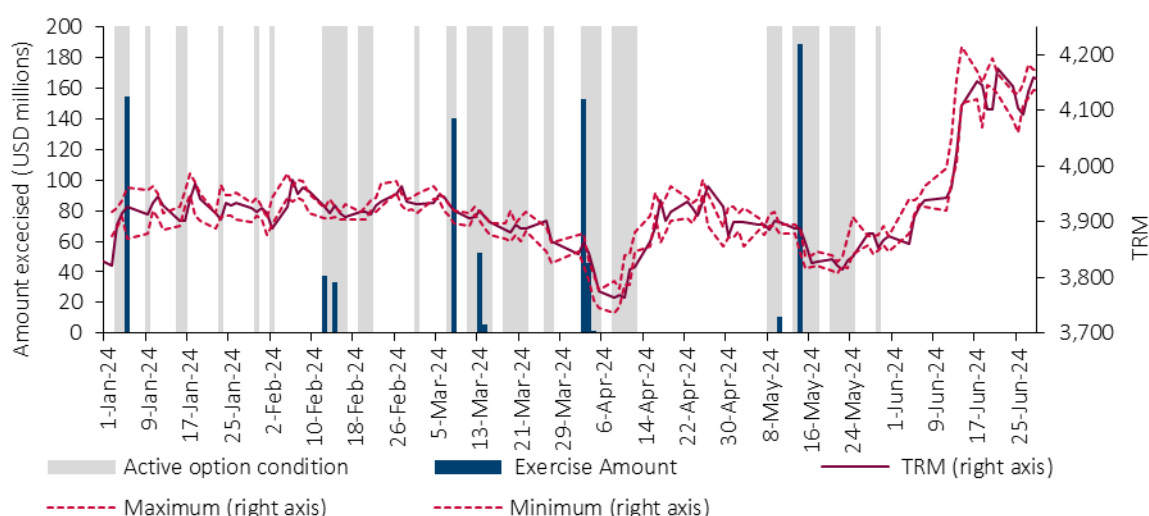
<sup>100</sup> The agents must report the intention to exercise between 10 a.m. and 1 p.m., and the transaction must be carried out that day until 3 p.m.

It is important to note that the interventions using this mechanism are usually relatively small compared to the volumes traded in the spot market. This ensures that the instrument does not affect market liquidity conditions. Thus, *Banrep's* interventions have no impact on the volatility or level of the exchange rate. In the recent period, the average monthly volume traded in the foreign exchange market in 2024 has been approximately USD 26,400 million. This amount is significantly higher than the USD 200 million per month accumulated through put option auctions. Therefore, the Foreign Reserves Accumulation Program represents only 0.8% of the monthly traded amount on average, indicating the limited impact *Banrep's* intervention could have on the foreign exchange market.

### Evolution of the Reserves Accumulation Program

During the first half of 2024, six put option auctions for FRs accumulation were conducted, totaling USD 1,200 m, and the exercise condition was active for 55 trading days. Each auction has registered a significantly higher demand than the available quota, which totals USD 6,444 m, demonstrating strong market appetite for the instrument.

Graph B2.2 Exercise of Put Option for Reserves Accumulation



**Source:** *Banrep*. **Note:** The graph shows the periods during which the exercise condition of *Banrep's* reserve accumulation put options has been active, that is, the periods in which the TRM is below the 20-day moving average. It also shows the amounts exercised. Additionally, the graph includes the TRM in effect for each trading day and the trading range (maximum and minimum) for each day.

At the end of June, *Banrep* had accumulated FRs for USD 824.9 m, representing 69% of the resources auctioned so far and 55% of the program's total target (USD 1,500 m). Most of the accumulation occurred between March and May. Due to the depreciation trend of the peso in June, the exercise condition was not active, leading to no dollars being sold to *Banrep* (Graph B2. 2).

In line with the reserve accumulation throughout the year, FRs have increased by USD 1,293 m, totaling USD 60,901 m by June 2024. This increase is also attributed to positive returns on foreign reserves obtained during the year, supported by higher international interest rates.

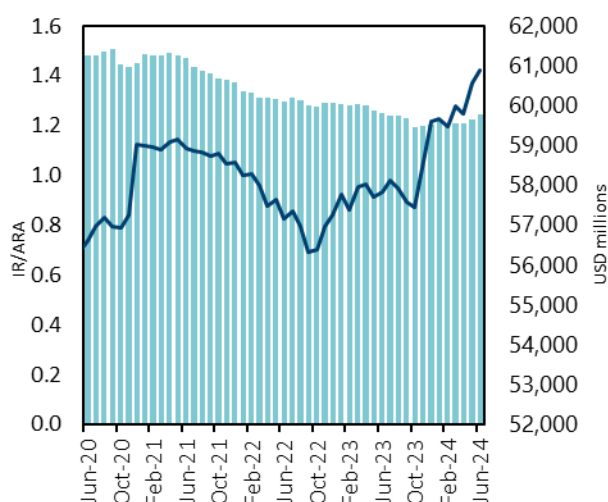
In line with the above, different metrics used to assess the adequacy of FRs indicate that these are at adequate levels. The methodology proposed by the IMF shows a slight improvement (Table B2. 1 and Graph B2. 3). The methodology, known as Assessing Reserve Adequacy (ARA)<sup>101</sup>, aims to cover risks associated with the loss of access to external financing, loss of confidence in the local currency, reversal of capital flows, and potential collapse in external demand<sup>102</sup>. An economy is considered to maintain adequate reserve levels if the ratio of FRs to ARA falls between 1.0 and 1.5. With the latest available data, as of June 2024, Colombia’s ratio stood at 1.24, compared to 1.21 in December 2023. Additionally, Colombia ranks fourth in the FRs/ARA metric among its regional peers, ranking close to Mexico.

Table B2. 1 FRs Adequacy Metrics

Metric	June-24	Recommended range
FRs / M3	30.2%	Greater than 20%
FRs / Imports	9.34	Greater than 3
FRs / (External debt repayments + current account deficit)	0.97	Greater than 1
FRs / ARA	1.24	Between 1 and 1.5

Source: Banrep.

Graph B2. 3 Evolution of FRs and the FRs/ARA Ratio



Source: Banrep.

## Valuation of Options Auctioned in 2024

Studies on the value of the options used by *Banrep* highlight a difference between the theoretical price calculated by models and the auctioned value. Authors suggest that this difference may be due to low demand for the options during auctions, limited market knowledge about the instrument, or a valuation of volatility that differs from the market-observed volatility. First, Stozitzky (2015) uses the algorithm proposed by Longstaff and Schwartz (2001), the least squares monte carlo (LSM), modified to include a Merton (1976) mixed jump-diffusion model. His findings indicate that a deviation from the theoretical price could be explained by low demand for the options at the time of auction or limited market knowledge about the instrument. Second, Rojas and Villamizar (2021) (WTC) find similar results by replicating the value of American options using a portfolio of European options<sup>103</sup>. According to these methodologies, there is a positive relationship between the premium paid for the option and the exchange rate volatility, suggesting

<sup>101</sup> For further details, see Moghadam *et al.*, 2011, IMF (2013) and IMF (2015).

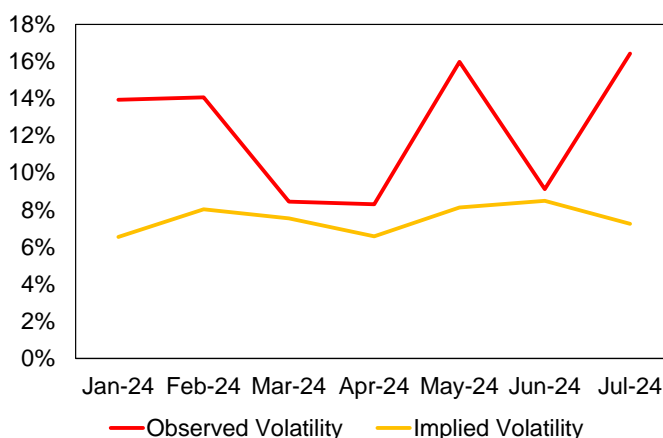
<sup>102</sup> This metric establishes that reserves should cover the main balance of payments risks in foreign exchange market pressure periods.

<sup>103</sup> A European option is a type of financial contract that gives the holder the right, but not the obligation, to buy or sell an underlying asset at a predetermined price on a specific date. In turn, the buyer can exercise an American option at any time, before and at maturity.

that the estimated value of the options might differ from the auctioned value because agents use a measure of volatility different from the one observed in the market.

**When replicating the LSM and WTC methodologies, it is found that agents estimated an implied volatility lower than the one observed in the market (Graph B2. 4).** When submitting their bids, each agent may value the option based on market conditions, exchange rate volatility, and the performance of their 20-day moving average, among other factors. Using the auction cut-off price suggests that, on average, agents have valued the option price with a lower volatility than the market volatility observed that day.

**Graph B2. 4 Estimated Implied Volatility and Observed Volatility**



**Source:** Banrep. **Note:** The calculation of implied volatility is obtained as the average of the implied volatilities using the two valuation methodologies (LSM and WTC)

**In addition, there is no clear relationship between the option price and the amount bid.** A high discrepancy in the prices presented by agents across different auctions is highlighted. This is evident in the bids presented in the auctions, where it is possible to find bids from COP 1,300 to COP 29,000 per USD 1,000.

**Based on the results of the FRs accumulation option auctions held to date, it is observed that participants typically offer a higher premium in exchange rate appreciation scenarios. On the other hand, in appreciation scenarios, agents tend to exercise options on the first days of the month.** Graph B2. 5 illustrates the positive and significant relationship<sup>104</sup> between the difference between the TRM and its 20-day moving average<sup>105</sup> and the ratio of the TRM to the auction cut-off premium for the day<sup>106</sup>. This relationship suggests that agents tend to pay a higher premium relative to the TRM for the auctioned option when the exercise condition is active. Moreover, when

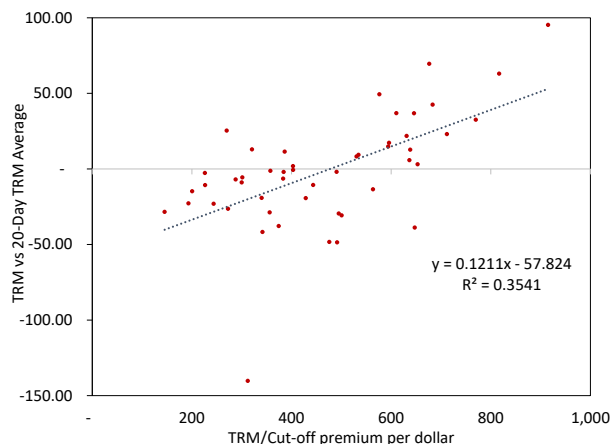
<sup>104</sup> The regression coefficient associated with this relationship is significant, and the coefficient of determination ( $R^2$ ) is positive and significant.

<sup>105</sup> Values below zero indicate that the exercise condition is active on the day of the auction. It could also be interpreted as a variable that measures the short-term appreciation trend of the exchange rate, with positive values representing a depreciation trend and negative representing an appreciation trend.

<sup>106</sup> To make the premium comparable over time, its value is scaled with respect to the TRM of the day of the auction. In this way, a higher premium value concerning the TRM would indicate a higher option value.

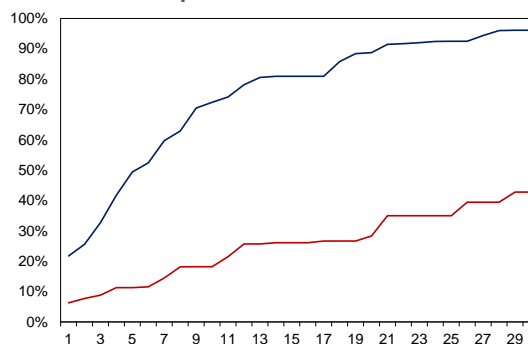
agents acquire options during periods of Colombian peso appreciation, they tend to exercise, on average, 80% of the auctioned amount within the first 15 days of the month (*Graph B2. 6*). In contrast, when participants purchase options in depreciation scenarios, agents exercise, on average, 42% of the option’s value. These findings suggest that agents often pay a higher price for these options in exchange rate appreciation scenarios.

**Graph B2. 5 Exchange Rate Trend and Auction Cut-Off Price**



**Source:** *Banrep*. **Note:** To approximate the short-term trend of the exchange rate, the difference between the TRM on the auction day and the 20-day moving average of the TRM is used. The auction price variable is scaled relative to the TRM value on the auction day.

**Graph B2. 6 Cumulative Execution Percentage of Auctions in Appreciation Scenarios and Average Cumulative Execution Percentage of Auctions in Depreciation Scenarios**



**Source:** *Banrep*. **Note:** The blue line represents the average daily cumulative execution of auctioned options on the day when the TRM was below its 20-day moving average. In contrast, the red line represents the average daily cumulative execution of auctioned options on the day when the TRM was above its 20-day moving average.

## Conclusions

**The Foreign Reserves Accumulation Program has proven effective in strengthening external liquidity levels amid reduced access to the FCL and a persistently complex international environment. The program is expected to continue strengthening the country’s external position, with FRs levels expected to remain adequate according to various metrics.** This will allow the economy to face risks and challenges that may arise in an uncertain global economic environment with greater resilience, ensuring greater stability and responsiveness to potential financial crises or market fluctuations.

**In addition, it is important to note that the program has not affected liquidity conditions and depth of the foreign exchange market.** This is because the auction amounts are lower than the trading volumes in the market. Specifically, the Foreign Reserves Accumulation Program accounts for only 0.8% of the average monthly trading volume in the foreign exchange market, ensuring that the intervention of *Banco de la República* (the Central Bank of Colombia) has no impact on the volatility or the exchange rate level.

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