Macro Vision

May 23, 2024

Revisiting estimates for the neutral interest rate in Brazil

- The Brazilian Central Bank (BCB) is expected to update its estimates for the neutral real interest rate in the 2Q24 Quarterly Inflation Report.
- Using the methodologies outlined by the BCB in a box of the June 2023[1] report titled “Neutral real interest rate metrics in Brazil” we estimate that the median neutral real interest rate increased marginally from 1Q23 to 1Q24 (from 4.6% to 4.7%). However, the evolution of the rate in recent quarters depends on the methodology used because rates derived from the output gap increased while those estimated by real market rates declined.
- Considering other methodologies (in addition to those presented by the BCB) that use the output gap calculated by Itaú, the Taylor Rule, or structural models, we observe a sharper increase in neutral interest rates over the last few quarters of 0.5 to 1.0 percentage points (to approximately 6.0%).

Real interest rate in Brazil

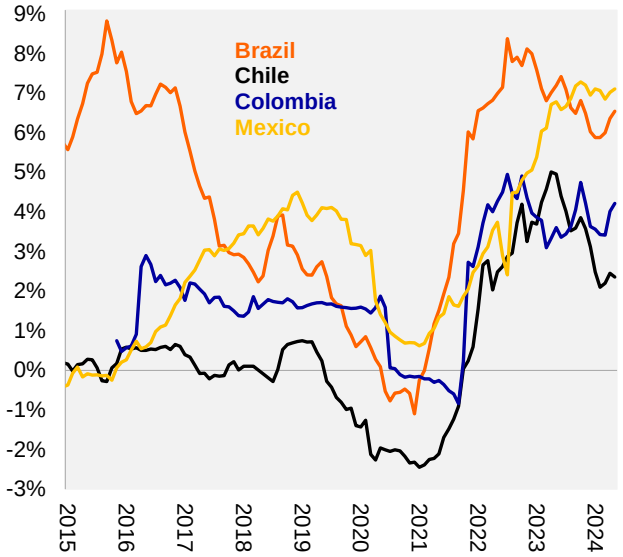
Historically, Brazil’s real interest rates are higher than international standards, even when compared to emerging market economies, due to the country's particular economic and structural challenges. Inflationary persistence, weaker control over public accounts, and existing distortions in the Brazilian economy contribute to higher interest rates.

In recent years, however, ex-ante real interest rates have been on a downward trend in Brazil. The graph below shows that since mid-2016, interest rate has been decreasing due to falling inflation, fiscal adjustment measures - such as the spending cap that led to a (temporary) break in the pattern of rapid expenditure growth seen since the mid-1990s - and structural reforms that made progress during that period.

This trend was interrupted in mid-2021 by inflationary pressures resulting from supply and demand shocks, combined with the fiscal expansion required to mitigate the negative effects of the pandemic on economic activity. In August 2023, when the BCB began the monetary easing cycle due to a better inflation situation, Brazilian rates resumed their downward trend even earlier than their peers.

[1] Available at https://www.bcb.gov.br/content/ri/relatorioinflacao/202306/ri202306b6p.pdf

***Ex-ante* real interest rates: Brazil and emerging market economies**



Source: BBG, Itaú

Neutral or equilibrium interest rate

The equilibrium real interest rate, or neutral interest rate, is the level that balances the supply and demand for savings and investments. In other words, it is the level that is consistent with GDP at its potential and inflation at the target. Estimating this rate involves a high degree of uncertainty due to it being a latent (unobservable) variable and is quite sensitive to the chosen method. Therefore, users should utilize different methods to make these estimates more robust.

Nevertheless, the neutral interest rate is extremely relevant to the decisions made by economic agents. The relationship between the real effective interest rate and the neutral interest rate allows us to infer the calibration of monetary policy. It is worth noting that in recent communications, the BCB expressed a caveat that, even though it implemented a monetary easing cycle, the goal is to *"maintain the contractionary monetary policy necessary for the disinflationary process."* In other words, the BCB intends to reach the end of the easing process with the interest rate above neutral.

Considering the numerous difficulties and complexities, the following sections present various estimates of the equilibrium interest rate obtained through different methodologies, from statistical filters to models based on economic theory. Since the rate varies over time based on the evolution of different variables - such as potential growth, economic agents' preferences, efficiency in the financial system, and economic risk premiums - the objective of this study is to reevaluate estimates for the neutral interest rate, emphasizing its behavior in recent quarters.

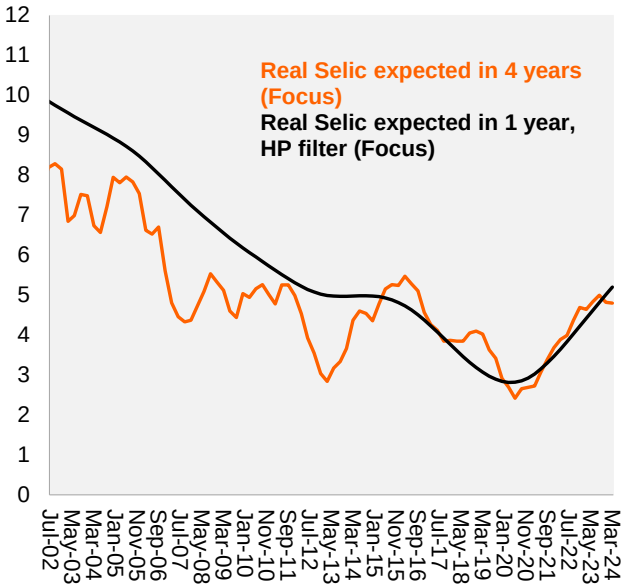
This report has 6 sections, in addition to the conclusion. Each section presents a different estimate of the neutral rate. Estimates 1-4 were introduced by the BCB in the June 2023 Quarterly Inflation Report, while estimates 5-6 were derived from other methodologies.

1. Ex-ante real interest rate based on the Focus survey

We estimate the real short-term interest rate (1 year) by using the median projection for the nominal interest rate in the next 12 months (extracted from the BCB's Focus Survey) deflated by the median of inflation expectations for the same timeframe. To remove cyclical moves, we apply the Hodrick-Prescott Filter (HP). For estimating the medium-term neutral interest rate (4 years), we utilize the Focus survey's projections for nominal interest rates and deflate

them using estimates for the consumer price index IPCA for the same timeframe.[2] The graph below illustrates an upward trend starting in mid-2021, with estimates increasing to 5.2% in 1Q24 (from 4.4% in 1Q23) for the 1-year term, and to 4.8% (from 4.6%) for the medium-term rate.

Real *ex-ante* Selic rate based on the Focus survey



Source: BCB, Itaú

2. High and low frequency neutral rates

The high frequency interest rate is defined by this stylized IS curve:

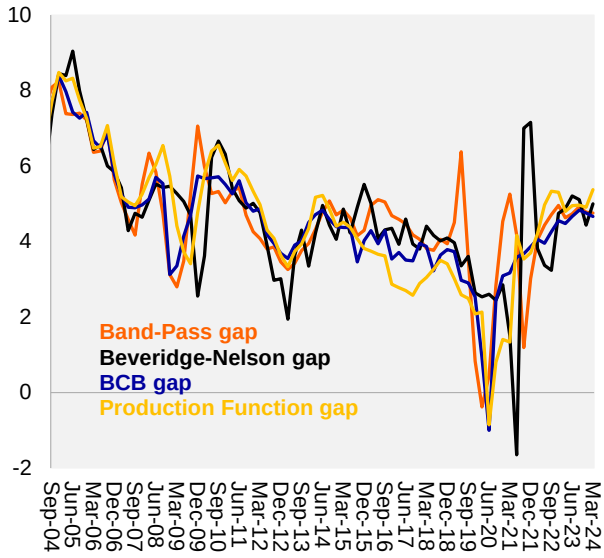
$$gap_t = 0{,}84 * gap_{t-1} - 0{,}75 * (R_t^{Focus} - R_t^{neutral})$$

Where gap_t are measures of the output gap estimated under different metrics (Band-Pass Filter, Beveridge-Nelson Filter, gap published by the BCB in its Quarterly Inflation Reports and gap based on the Production Function) and R_t^{Focus} is the real 4-year *ex-ante* rate based on the Focus survey and discussed in the previous section. The following graph on the left shows that estimates for 1Q24 ranged from 4.7% to 5.4% vs. 4.5% to 4.9% in 1Q23.

To estimate low frequency rates, we apply an HP Filter to high frequency estimates. The results are in the graph on the right and varied between 4.7% and 5.2% in March 2024, while ranging from 4.2% to 4.5% in 1Q23.

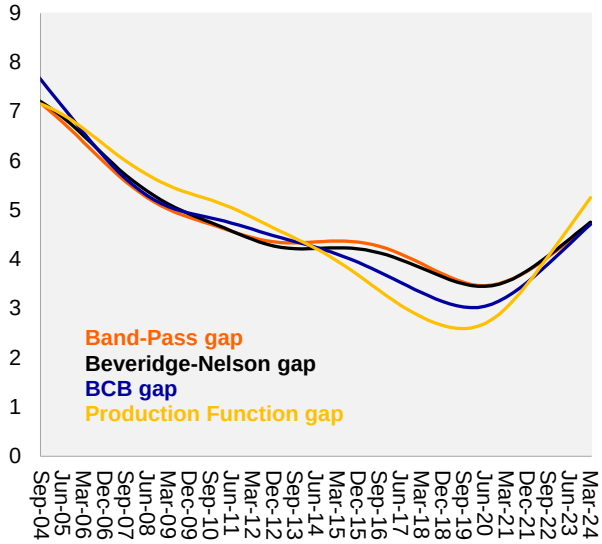
[2] In this case, no statistical filter is applied because we use the same assumption as the BCB in the box "Neutral real interest rate metrics in Brazil" of the June 2023 Quarterly Inflation Report, that longer rates free of risk premiums usually are adequate estimates for the neutral rate.

High frequency neutral interest rate



Source: IBGE, BCB, Itaú

Low frequency neutral interest rate

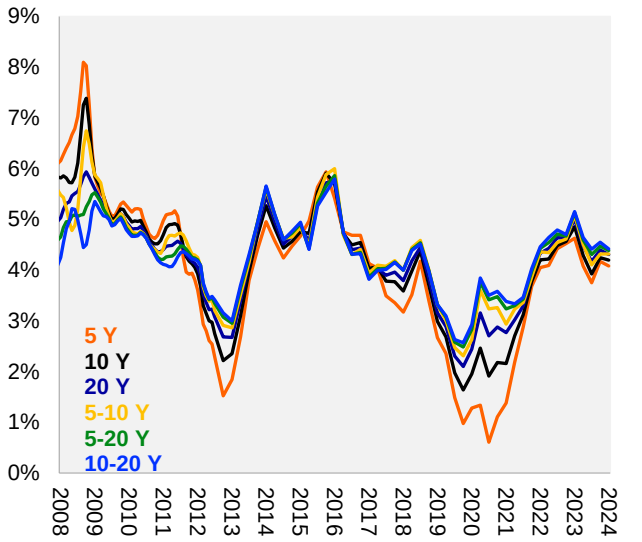


Source: IBGE, BCB, Itaú

3. Real market rates

To estimate the neutral interest rate using real market rates, we utilize the National Treasury's B Series bonds (NTN-B) discounted by the term premium (defined as the difference between real market rates and real rates based on the longest timeframe (4 years) of the Focus survey. The results presented in the graph below show that the rate varied between 4.1% and 4.4% in 1Q24 (4.6%-5.2% in 1Q23).

Real NTN-B rates discounting the term premium



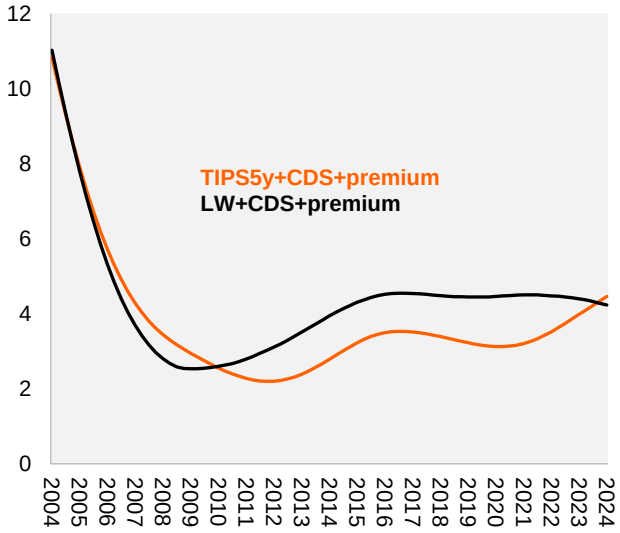
Source: Itaú, BBG

4. Uncovered interest rate parity

In an open economy with capital flows, there is a relationship between domestic and international interest rates, defined by the uncovered interest rate interest parity.[3] Therefore, we calculate Brazil's neutral interest rate as the real interest rate in the US[4] plus a sovereign risk premium (Brazil's 5-year CDS) and exchange rate risk premium.[5]

The results presented in the graph below show that the rate is now between 4.0% and 4.5%, in line with 1Q23.

Neutral rates based on external rates and risk premium



Source: BBG, Itaú, Fed

5. Monetary policy rule

To estimate the neutral interest rate using monetary policy rules, our central assumption is that the equilibrium rate is achieved when GDP is at its potential level and inflation is consistent with the target. In other words, we start from a Taylor Rule[6]:

$$i_t = \alpha + IPCA_t^{12m} + \alpha_1 * gap_t + \alpha_2 * (IPCA_t^{12m} - target_t)$$

Where the constant α represents the equilibrium real interest rate, $IPCA_t^{12m}$ is the median of inflation projections 12 months ahead based on the Focus survey, and gap_t is calculated using the production function. When estimating the Taylor Rule, we find a constant - or average neutral real interest rate - ranging between 5.5% and 6.7%, depending on the specification and sample used.

However, the average is not informative of the dynamics of neutral interest rates over time. To capture this dynamic by allowing the Taylor Rule intercept to vary over time, we use two different methodologies: (i) estimating the equation for rolling regressions and (ii) defining the neutral interest rate as a state variable and solving the dynamic system via Kalman Filter. The graph below highlights the average of these results, showing that the neutral interest rate increased by 1pp during the last year (from 3.7% in 1Q23 to 4.7% in 1Q24[7]).

[3] Domestic and international interest rates should be equal when adjusted for FX risk and expectations.

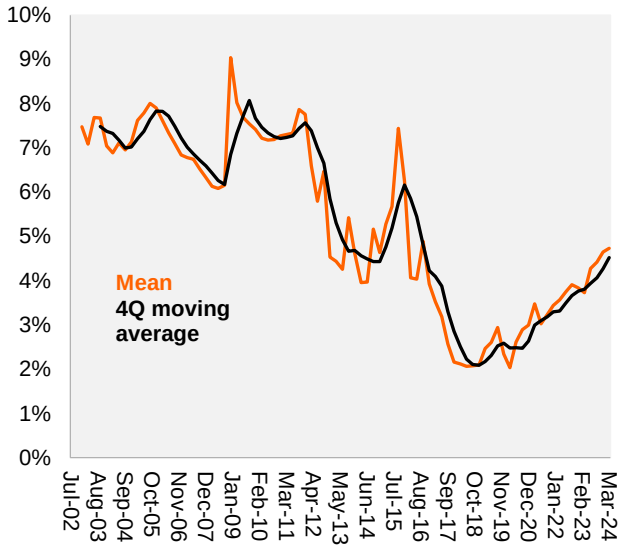
[4] We use two variables: 5-year Treasury Inflation-Protected Securities (TIPS) and the bilateral interest rate of the Laubach-Williams model, published by the Federal Reserve Bank of New York (FED-NY).

[5] The FX risk premium is calculated by subtracting the FX coupon and expected depreciation of the BRL against the USD (based on the Focus survey) from the domestic interest rate.

[6] We use two other functional forms of the Taylor Rule by inserting an external variable (US interest rate gap).

[7] Considering the 4-quarter moving average.

Neutral interest rate derived from the Taylor Rule



Source: BCB, Itaú

6. Structural models

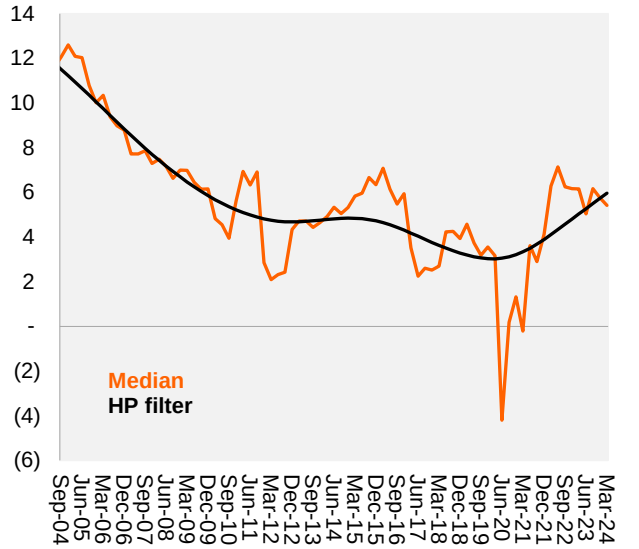
Based on a study by Goldfajn and Bicalho (2011), we estimate the neutral real interest rate using a broad set of structural variables - beyond the output gap, inflation, and international interest rates. According to the authors, the relationship between structural variables and the real interest rate can be tested through the following equation:

$$r_t = \beta_0 + \beta_1 t + \beta_2 X_t + \varepsilon_t$$

Where $r_t$is the real interest rate, t is a linear trend, and $X_t$is a vector of structural variables. In this case, the neutral interest rate would be equal to $\overline{r_t} = r_t - \varepsilon_t$.

In the article “The Long Crossing to Normality: The Real Interest Rate in Brazil,” Goldfajn and Bicalho (2011) included country risk premium, public debt, and credit stock as a share of GDP as structural variables. When evaluating the period between 1999 and 2008, the authors concluded that the decline in the country's risk premium, the improvement in fiscal conditions, and credit growth explained the downward trend in interest rates during that period. In addition to considering the risk premium and a fiscal variable, our analysis separated non-earmarked loans from loans granted by the national development bank BNDES, and an external variable represented by the neutral interest rate in the US. The graph below shows the median of our estimates. After running the HP Filter, the equilibrium interest rate also increased by 1pp last year, from 5.0% in 1Q23 to 6.0% in 1Q24.

Neutral interest rate derived from structural models



Source: BCB, Itaú

Conclusion

The table below summarizes the main results of this study.

The first section provides an update on the methodologies outlined by the BCB in the box “Neutral real interest rate metrics in Brazil,” released in June 2023. The median neutral interest rate saw a slight increase from 1Q23 to 1Q24. However, the trajectory of the rate in recent quarters varies significantly depending on the methodology employed. Neutral rates based on economists' projections have shown an upward trend in recent months. Similarly, estimates derived from the output gap have also increased in the short term, reflecting the consistent positive surprises in activity observed in recent months. Conversely, rates derived from real market rates experienced a decline between March 2023 and March 2024.

The second section includes other methodologies followed by Itaú, in addition to those presented by the BCB. These estimates, which use our output gap figure, Taylor Rule, or structural models, point to a sharper increase in neutral interest rates in recent months. Activity continued to deliver positive surprises in early 2024. With unemployment at 7.4% by the end of 1Q24, the output gap is wider than in 1Q23, leading to a significant increase in the neutral interest rate according to this metric.

Neutral interest rate - Different measures estimated by the BCB in June/23								
	Before 2008	2009-2011	2012-2016	2017-2019	2020-2021	2022-1Q24	1Q23	1Q24
Ex-ante real Selic rate from the Focus survey								
Real Selic expected in 4 years	6.6%	5.0%	4.3%	3.8%	2.9%	4.6%	4.6%	4.8%
Real Selic expected in 1 year, HP filter	8.5%	5.9%	4.9%	3.4%	3.0%	4.4%	4.4%	5.2%
High frequency neutral rates								
Band-Pass gap	6.9%	5.0%	4.3%	4.0%	2.6%	4.7%	4.6%	4.8%
Beveridge Nelson gap	6.9%	5.1%	4.1%	3.9%	3.1%	4.4%	4.9%	5.0%
BCB gap	6.6%	5.1%	4.2%	3.4%	2.5%	4.5%	4.5%	4.7%
Low frequency neutral rates								
Band-Pass gap	6.9%	4.7%	8.0%	3.8%	3.6%	4.3%	4.3%	4.7%
Beveridge Nelson gap	6.9%	4.8%	4.2%	3.7%	3.6%	4.3%	4.3%	4.8%
BCB gap	6.6%	4.9%	4.2%	3.3%	3.2%	4.2%	4.2%	4.7%
Real market rates discounted of the term premium								
5 years			4.5%	3.1%	1.8%	4.2%	4.6%	4.1%
10 years			4.6%	3.4%	2.5%	4.3%	4.9%	4.2%
20 years			4.7%	3.5%	3.0%	4.5%	5.0%	4.3%
5-10 years			4.7%	3.7%	3.3%	4.5%	5.1%	4.3%
5-20 years			4.7%	3.7%	3.4%	4.6%	5.1%	4.4%
10-20 years			4.7%	3.7%	3.5%	4.6%	5.2%	4.4%
Uncovered interest rate parity								
Tips5Y+CDS5y+risk premium			3.3%	3.3%	3.2%	4.0%	4.0%	4.5%
LW+CDS5y+risk premium			4.3%	4.5%	4.5%	4.4%	4.4%	4.2%
Natural interest rate from the Samba model								
Two years future rate							4.5%	
Five years future rate							4.8%	
Neutral real interest rate from the PCQ*								
Short-term median							4.8%	5.0%
2 years median							4.8%	5.0%
5 years median							4.5%	4.8%
Median BCB	**6.9%**	**5.0%**	**4.4%**	**3.7%**	**3.1%**	**4.4%**	**4.6%**	**4.7%**
Mean BCB	**7.0%**	**5.1%**	**4.6%**	**3.6%**	**3.1%**	**4.4%**	**4.6%**	**4.6%**

Neutral interest rate - Additional measures								
	Before 2008	2009-2011	2012-2016	2017-2019	2020-2021	2022-1Q24	1Q23	1Q24
Taylor Rule								
- Constant intercept	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%
- Rolling intercept		7.5%	5.3%	0.0%	2.8%	3.9%	3.8%	4.5%
- Kalman Filter	8.3%	4.7%	3.7%	5.6%	2.3%	6.8%	6.8%	6.9%
Structural models								
- Goldfajn e Bicalho	9.9%	5.5%	4.7%	3.5%	3.4%	5.0%	5.0%	6.0%
High frequency neutral rates								
- Itaú gap	6.9%	5.3%	4.1%	2.9%	2.0%	5.0%	4.8%	5.4%
Median Itaú	**7.6%**	**5.5%**	**4.7%**	**3.5%**	**2.8%**	**5.0%**	**5.0%**	**6.0%**
Mean Itaú	**7.8%**	**5.9%**	**4.8%**	**3.7%**	**3.4%**	**5.4%**	**5.3%**	**5.8%**
Median BCB and Itaú	**6.9%**	**5.1%**	**4.5%**	**3.7%**	**3.1%**	**4.5%**	**4.7%**	**4.7%**
Mean BCB and Itaú	**7.3%**	**5.4%**	**4.7%**	**3.6%**	**3.2%**	**4.6%**	**4.8%**	**4.9%**

*For 1Q24 we considered the PCQ of Dec/23, the last time the BCB included the neutral interest rate question in the questionnaire

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