

Box 1

The Macroeconomic Imbalance Index (MII) for Colombia

Darío Perdomo Sánchez
Nicolle Valentina Herrera Pinto*

1. Introduction

Macroeconomic imbalances are understood as the deviations of key variables from their long-term equilibrium values. These imbalances can accumulate over time, often during economic boom periods, increasing an economy's vulnerability to adverse shocks and preface economic contractions and financial crises (Arteaga *et al*, 2013). To monitor Colombia's vulnerabilities, the Macroeconomic Imbalance Index (MII), initially proposed by Arteaga *et al* (2013), was updated and re-estimated. This tool seeks to summarize, in the aggregate, the deviations of four key variables of the Colombian economy from their long-term equilibrium levels: credit, housing prices, the current balance of payments account, and the real exchange rate. Additionally, a fifth indicator was included in an attempt to estimate the degree of fiscal imbalance. This Box describes the methodology for calculating the new MII and details the results for Colombia.

2. Methodology for estimating individual imbalances

The MII is built from the individual gaps or imbalances of its five components. To do so, a long-term equilibrium or trend level is estimated for each of the five indicators by combining three complementary methodologies: statistical filters, structural models based on economic theory, and panel data models that incorporate international experience.¹

2.1 The credit imbalance

To analyze credit against its equilibrium level, total credit to the non-financial private sector is used in both real and per capita terms.² This variable avoids the potential distortions caused by the “denominator effect” of GDP fluctuations, a problem widely documented in the literature (Drehmann and Yetman, 2021; Repullo and Salas, 2011). The imbalance estimate combines three approaches. First, a cycle is obtained using the median of the trends generated by a set of univariate statistical filters³ with parameters adjusted for financial cycles with a quarterly frequency (Baba *et al*, 2020). Secondly,

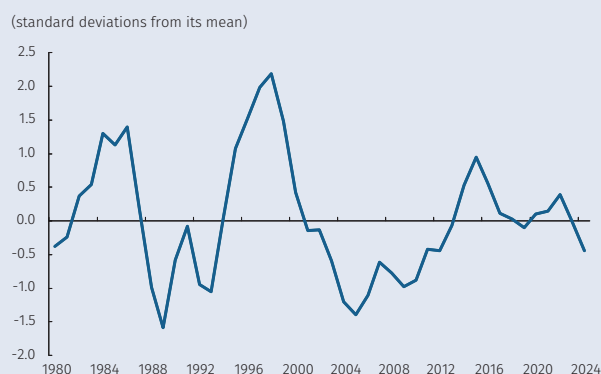
* The authors are analysts at the Programming and Inflation Department. The opinions herein expressed are solely their responsibility and do not compromise the Bank or its Board of Directors. The authors wish to thank Carlos Huertas Campos, Viviana Alfonso Corredor, Manuela Quintero Jácome, David Camilo López Valenzuela, Steven Zapata Álvarez, Nicol Valeria Rodríguez Rodríguez, and Marlon Salazar Silva.

1 Although some methodologies use quarterly data, the resulting gaps are annualized by computing a simple average for each year, ensuring a standard frequency for aggregating the indicator.

2 Total credit data to the non-financial private sector are reported by the Bank for International Settlements (BIS).

3 Rolling average, Hodrick–Prescott (conventional and one-sided), STL, Hamilton, Baxter–King, Christiano–Fitzgerald, Butterworth, and trigonometric regression.

Graph B1.1
Average credit imbalance



Sources: Calculations by the authors.

an annual-frequency panel data model (FMOLS)⁴ is estimated following Baba *et al* (2020) to capture the long-term relationship between credit and its macroeconomic fundamentals, including real GDP per capita, real deposits (M3) per capita, the real interest rate, and the demographic dependency ratio. Next, a structural model (VEC) with quarterly frequency is employed, following Galán and Mencía (2018), to estimate the leverage gap, which measures credit deviations from its equilibrium level.⁵ Finally, a single imbalance indicator for credit is constructed by averaging the results of the three methodologies (Graph B1.1). Overall, the indicator successfully captures the recessions of the 1980s and 1990s, which were characterized by high levels of credit followed by financial crises. However, it fails to capture the episode of excess credit observed during 2006–2007,⁶ which occurred amid bank liquidations of TES holdings (TES bonds are issued by the Colombian government and managed by *Banco de la República*), high international oil prices, low interest rates, and significant capital inflows⁷ (López *et al*, 2020). Successively, the indicator shows a marked increase in credit imbalance during 2014–2015, coinciding with a sharp real rise in mortgage credit and housing prices, as well as the elevated international oil prices observed in previous years.⁸ For 2024, the indicators suggest low credit imbalance; therefore, this factor does not represent a significant source of relevant macroeconomic vulnerability according to this measurement.

2.2 Housing price imbalance

The real estate market assessment is derived from the used housing price index (IPVU, for its Spanish acronym), estimated in real terms by *Banco de la República*.⁹ Similarly, the housing price imbalance is determined using three methodologies. In the first, quarterly statistical filters are applied to estimate the median trend of the real IPVU and then determine its cycle. The second employs a panel data model (FMOLS)¹⁰ with an annual frequency based on the determinants identified by Tripathi (2019) to estimate a price level compatible with fundamental criteria that include GDP per

4 The countries considered are Australia, Colombia, Spain, Finland, Ireland, the United States, the United Kingdom, Italy, Canada, Chile, Korea, Mexico, Austria, Belgium, France, Germany, Hungary, Israel, the Netherlands, Norway, Portugal, Sweden, Switzerland, India, Indonesia, Malaysia, and Singapore.

5 The model incorporates a vector of endogenous variables comprising credit, real GDP, the real interest rate, and housing prices in real terms, and it imposes a long-term one-to-one relationship between credit and GDP.

6 In 2006, there was a credit supply shock financed by the sale of TES public debt securities. This episode was widely documented in the Reports to Congress and Financial Stability Reports published during that period by the Central Bank of Colombia.

7 The absence of a signal in the indicator could stem from its structural components interpreting the expansion of credit as consistent with the strong performance of macroeconomic fundamentals during that period.

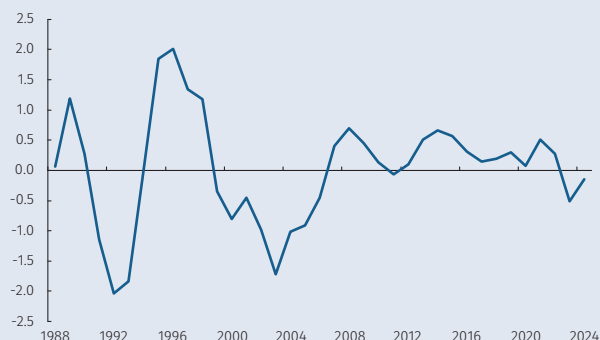
8 Although crude prices fell and the housing boom ended in 2015, the credit stock continued above its long-term trend.

9 The IPVU estimated by *Banco de la República* includes data since 1988.

10 The countries considered are Australia, Colombia, Spain, Finland, Ireland, the United States, the United Kingdom, Italy, Canada, Korea, Belgium, France, Germany, Israel, the Netherlands, Norway, Portugal, Sweden, and Switzerland.

Graph B1.2
Average used housing prices imbalance

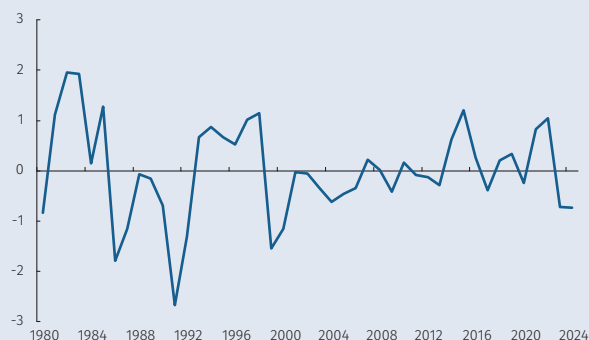
(standard deviations from its mean)



Sources: Calculations by the authors.

Graph B1.3
Average current account imbalance

(standard deviations from its mean)



Sources: Calculations by the authors.

capita, credit, working-age population, rents, and price-to-income and price-to-rent ratios.¹¹ The third is the estimate of the non-fundamental component of housing prices, which uses the PSY-IVX methodology initially proposed by Phillips and Shi (2023) and subsequently applied to the Colombian case by Rodríguez and Perdomo (2025).¹² This last methodology allows the series to be broken down into two components: a fundamental component and another component that seeks to capture deviations associated with speculative behavior. To conclude, a single imbalance indicator for used housing prices is structured by averaging the results of the three methodologies outlined above (Graph B1.2). This indicator captures the housing boom and subsequent crisis observed in the second half of the 1990s and currently does not suggest that housing prices are a source of macroeconomic vulnerability.

2.3 Current account imbalance

The potential vulnerabilities of the external sector are assessed by measuring the deviation of the current account deficit from its reference level, which is defined by its fundamental determinants under various approaches. This assessment relies on three methodologies: (i) the application of univariate statistical filters; (ii) a cointegration model between external income and expenditure that verifies the long-term relationship between the country's trade and income flows (Arteaga *et al*, 2013; Husted, 1992); and (iii) a panel data model (FMOLS) which, following Torres and Cote (2017), Barbosa *et al* (2024), and Salazar (2025), estimates a current account norm based on fundamentals such as credit, public debt, relative GDP per capita, and Net International Investment Position (NIIP).¹³ Finally, a single imbalance indicator for the current account is constructed (Graph B1.3), where positive values indicate a current account deficit above its equilibrium level. Overall, the indicator captures episodes in which the deficit widened significantly—such as the period preceding the 1994–1999 recession, the deterioration in the terms of trade in 2014, and the surge in domestic demand in 2022. Under this methodology, the current readings do not signal vulnerability arising from the external current account deficit.

2.4 Real exchange rate imbalance

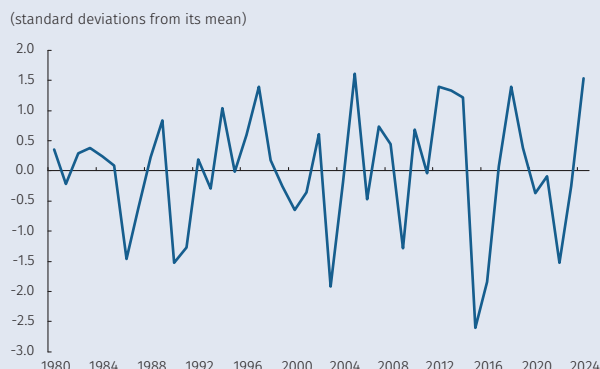
The imbalance signal from the real exchange rate is measured using three standard methodologies from the literature. The first is relative purchasing power parity (RPPP), which estimates the long-term trend using the median of univariate statistical filters at a quarterly frequency, following Arteaga *et al* (2013). The second approach is the behavioral equilibrium exchange rate (BEER), which approximates the real equilibrium exchange rate based on macroeconomic fundamentals – such as fiscal variables, external conditions, and productivity – using the BEER methodology of Miles,

11 The price-to-income ratio measures the affordability of housing in relation to household income while the price-to-rent ratio captures the relative profitability of buying a property versus renting it.

12 The authors apply seven categories of macroeconomic fundamentals to the Colombian case: rents, interest rates, macroeconomic conditions, uncertainty, demand factors, supply factors, and production costs.

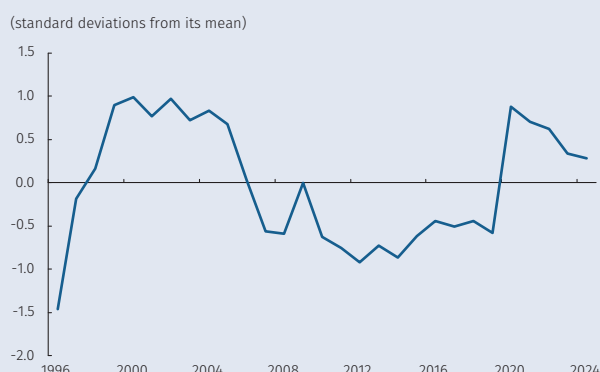
13 The countries considered are Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, Guatemala, Honduras, Jamaica, Panama, Paraguay, Peru, El Salvador, India, Indonesia, Israel, Jordan, Korea, Malaysia, Nepal, Pakistan, Papua New Guinea, and the Philippines.

Graph B1.4
Average real exchange rate imbalance



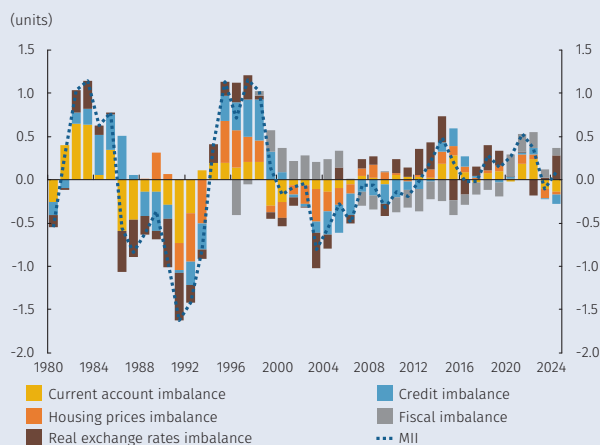
Sources: Calculations by the authors.

Graph B1.5
Average fiscal imbalance



Sources: Calculations by the authors.

Graph B1.6
Macroeconomic imbalance index by component ^{a/}



a/ Each component is expressed in normalized units and weighted by the weights of the main components.
Sources: Calculations by the authors.

Adler, and Grisse (2017) applied to Colombia by Salazar *et al* (2023), which incorporates several econometric specifications. The third methodology employed is the fundamental equilibrium exchange rate (FEER), which computes the real equilibrium exchange rate level needed to ensure external equilibrium by closing the gap between the underlying current account and the normative current account¹⁴ (Arteaga *et al*, 2013). Lastly, the aggregate imbalance indicator for the real exchange rate is constructed (Graph B1.4). Under this methodology, a positive imbalance value is observed in 2024, corresponding to an appreciation of the exchange rate.

2.5 Fiscal imbalance

The imbalance indicator, used to assess possible signs of fiscal vulnerability, is estimated using three complementary methodologies. The first approach is the debt service ratio (DSR), which measures the percentage of government revenue allocated to servicing the debt, and incorporates the implicit real interest rate, the average life, and the stock of debt in its computation (Drehmann and Juse-lius, 2012). The second methodology employed is a regional comparison index, which gauges the deviation of Colombia's key fiscal indicators¹⁵ from the average of a group of peer countries, including Brazil, Chile, Mexico, Peru, Paraguay, and Uruguay (Baldacci *et al.*, 2011; Ojeda *et al.*, 2012). The third methodology measures fiscal imbalance according to the difference between the primary balance that maintains a constant public debt-to-GDP ratio (which is contingent on the fundamentals of the real natural interest rate and potential GDP growth) and the primary balance adjusted for the economic and oil cycles (IMF, Fiscal Monitor). All three approaches interpret a positive value of the indicator as a sign of greater fiscal vulnerability. As a result (Graph B1.5), the aggregate fiscal imbalance indicator distinguishes periods when significant fiscal pressures contributed to macroeconomic vulnerability, particularly during 1998-2006 and, more recently, 2020-2024.

3. Construction of the aggregate MII

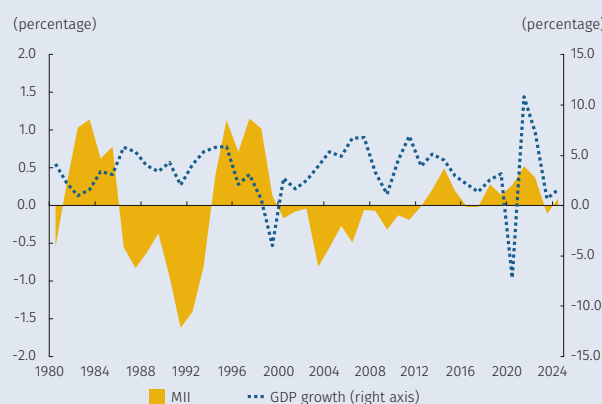
Once the five individual gaps have been estimated, they are standardized by subtracting their mean and dividing by their standard deviation, making them comparable. Following the original methodology of Arteaga *et al* (2013), the aggregate Macroeconomic Imbalance Index (MII) is constructed as a weighted average of these standardized gaps. The weights are obtained through principal component analysis (PCA), which assigns greater weight to the variables that explain a larger share of the system's joint variance, thereby capturing common imbalance dynamics¹⁶ (Graph B1.6). According to the graphical depiction, the current imbalance of the real exchange rate and the fiscal imbalance—potentially related—are the two primary sources of vulnerability for the Colombian

14 The normative current account refers to the level of the current account balance that is considered consistent with the macroeconomic equilibrium fundamentals.

15 It includes gross debt, net debt, the primary balance, and tax revenue as a percentage of GDP; the CDS (Credit Default Swap spread); the EMBI (Emerging Markets Bond Index spread); external debt as a percentage of total debt; the implicit real interest rate on public debt minus economic growth; and the NIIP (Net International Investment Position).

16 Due to the availability of IPVU data from 1988 onwards, for the 1980-1987 period the IDM re-estimates the weights using imbalances in the current account, the real exchange rate and credit.

Graph B1.7
Macroeconomic imbalance index and GDP growth



Sources: Calculations by the authors.

economy. This finding is consistent with some risks surrounding the macroeconomic forecast presented in this *Report*.

4. Historical imbalances analysis and assessment of the MII

An attractive attribute of a vulnerability indicator is that high positive values precede crises or periods of significant economic contraction (Arteaga *et al*, 2013). The historical behavior of the MII (Graph B1.7) demonstrates that it has indeed signaled several episodes of imbalance accumulation in the Colombian economy.

The most notable case corresponds to the period preceding the crisis of the late 1990s. Between 1994 and 1998, the MII displayed a marked and sustained buildup of imbalances, reaching its historical peak. This vulnerability was broad-based, with positive and significant contributions from most of its components (Graph B1.6). During this period, the economy experienced a credit boom, a sharp overvaluation of housing prices, persistent real currency appreciation, and a growing external deficit (Arteaga *et al*, 2013). The magnitude and breadth of these simultaneous imbalances—captured by the MII—would have served as a real-time warning of the economy's heightened fragility.

Following the crisis, the economy underwent a significant adjustment process, reflected in negative MII values during the first half of the 2000s. These improvements, however, were partly offset by fiscal deterioration. This fiscal imbalance stemmed largely from pressures on public spending associated with the crisis and the resulting increase in debt and debt-service burdens, which kept the government's structural position in a vulnerable zone. Between 2007 and 2008, the imbalances were low and mixed: although vulnerability pressures were amassing from the current account, housing prices, and the real exchange rate, they were counterbalanced by a strong fiscal correction. This macroeconomic context helps explain why the international financial crisis had much milder effects on the Colombian economy compared to the impacts seen during previous adverse external shocks.

The indicator also captured the high commodity-price cycle. Between 2013 and 2014, the MII recorded a new phase of imbalance accumulation, driven mainly by currency appreciation and a widening external deficit by 2014. The subsequent decline in oil prices from that year onward triggered a macroeconomic adjustment that was reflected in the gradual moderation of the index.

In 2021, the indicator reached a new peak—although still below the record observed in the late 1990s—driven by the strong recovery in domestic demand following the pandemic. Graph B1.6 illustrates the main contributors that year: a pronounced fiscal imbalance caused by high levels of debt and a large primary deficit, a historically high current account imbalance, and a significant increase in housing prices. Since 2022, a rapid and substantial correction has taken place, resulting in negative MII values by 2023. This adjustment was driven by a marked improvement on the external front, reflected in negative contributions from the current account and a correction in housing price imbalances, amid an increase in the monetary policy rates to restrictive levels. In 2024, the MII returned to positive but low levels, with vulnerability sources concentrated on the real exchange rate and public finances. Regarding the latter, there were marked increases in CDS and EMBI spreads, debt levels above those of regional peers, and greater deviations of the cyclically-adjusted primary balance (CAPB) from the primary balance consistent with a stable debt ratio. Recent figures for these variables in 2025 indicate that these imbalances continue to persist.

In summary, the MII is an indicator that quantifies the country's potential macroeconomic imbalances and has demonstrated its ability to detect periods wherein the economy has accumulated imbalances, increasing its vulnerability to adverse shocks.

References

- Adler, K., and C. Grisse. 2017. "Thousands of Beers: Take Your Pick." *Review of International Economics* 25 (5): 1078–1104.
- Arteaga-Cabrales, C., C. A. Huertas-Campos, and S. Olarte-Armenta. 2012. "Índice de desbalance macroeconómico [Macroeconomic Imbalance Index]." *Borradores de Economía* 744. Banco de la República.
- Baba, C., M. S. Dell'Erba, M. E. Detragiache, et al. 2020. "How Should Credit Gaps Be Measured? An Application to European Countries." *IMF Working Paper* 2020/006. International Monetary Fund.
- Baldacci, M. E., M. J. McHugh, and I. Petrova. 2011. "Measuring Fiscal Vulnerability and Fiscal Stress: A Proposed Set of Indicators." *IMF Working Paper* 2011/094. International Monetary Fund.
- Barbosa, J., D. Perdomo, and M. Salazar. 2024. "Current Account Deficit Behavior and Its Long-Term Relationship with Some Fundamental Determinants for Colombia and Other Countries in the Region." Box 1, *Monetary Policy Report*. Banco de la República.
- Drehmann, M., and M. Juselius. 2012. "Do Debt Service Costs Affect Macroeconomic and Financial Stability?" *BIS Quarterly Review*, September.
- Drehmann, M., and J. Yetman. 2021. "Which Credit Gap Is Better at Predicting Financial Crises? A Comparison of Univariate Filters." *International Journal of Central Banking* 17 (70): 1–31.
- Galán, J., and J. Mencía. 2018. "Empirical Assessment of Alternative Structural Methods for Identifying Cyclical Systemic Risk in Europe." *Working Papers* 1825. Bank of Spain.
- Husted, S. 1992. "The Emerging U.S. Current Account Deficit in the 1980s: A Cointegration Analysis." *The Review of Economics and Statistics*: 159–166.
- López, M., C. Bohórquez-Peñuela, J. E. Carranza, S. Moreno-Burbano, A. Grajales-Olarte, M. P. Latorre, and J. Pulido. 2020. "Credit and Real Effects in Colombia 2000–2017: Evidence from Microdata." *Essays on Economic Policy* 94: 1–55.
- Ojeda-Joya, J. N., J. E. Gómez-González, and N. Jair. 2012. "The Term Structure of Sovereign Default Risk in Colombia and Its Determinants." *Borradores de Economía* 709.
- Phillips, P. C., and S. Shi. 2023. "Diagnosing Housing Fever with an Econometric Thermometer." *Journal of Economic Surveys* 37 (1): 159–186.
- Repullo, R., and J. Saurina. 2011. "The Countercyclical Capital Buffer of Basel III: A Critical Assessment." *CEPR Discussion Paper* DP8304.
- Rodríguez-Rodríguez, N. V., and H. D. Perdomo-Sánchez. 2025. "Between Fundamentals and Speculation: Analysis of the Housing Market in Colombia." Internal document. Banco de la República.
- Salazar-Díaz, A., A. L. Garavito-Acosta, S. Restrepo-Ángel, and L. V. Arcila-Agudelo. 2023. "Real Equilibrium Exchange Rate in Colombia: Thousands of VEC Models Approach." *Lecturas de Economía* 99: 33–78.
- Salazar, M. 2025. "Assessing the Current Account Gap in Colombia: A Normative Estimation Approach." *Economics Section* 08-2025. The Graduate Institute of International Studies.
- Torres-Gorrón, J. E., and J. P. Cote-Barón. 2017. "A New Calculation of the Real Equilibrium Exchange Rate for Colombia: A Macroeconomic Balance Approach." *Borradores de Economía* 1030. Banco de la República.
- Tripathi, S. 2019. "Macroeconomic Determinants of Housing Prices: A Cross-Country Level Analysis." *MPRA Paper* 98089.