Box 1
Decomposition of the Net Interest Margin in Colombia and Chile

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This box contains the results of an approximation to the decomposition of the net interest margin based on an industrial organization model[1] of the Colombian and Chilean banking sectors. The choice of these countries obeys the fact that, historically, there has been a significant gap between their interest margin.

The model makes it possible to breakdown the *ex-post* margin ($MI_{ex\text{-}post}$) into a range of factors associated with the structure of the system. Conceptually, the ex-post margin refers to the intermediaries' income and outflow or expenses from their credit portfolio and deposit operations. Accordingly, in this sense, it is a measure of the return on banking activity. The later implies the ex-post margin is *after* the materialization of credit risk. Therefore, in principle, it is not an element that is part of the breakdown.

The analysis is based on the simplified structure of the banks' balance sheets presented in Table B1.1. To calculate the theoretical ex-post margin of the banking system, it is assumed banks maximize a utility function that does not consider credit risk (equation 1) subject to their balance sheet structure (equation 2), a minimum level of capital (equation 3), and a liquidity requirement [2] (equation 4).

Table B1.1
Structure of the Bank Balance Sheet

Assets	Liabilities
Reserves Requirement αD	Deposits D
Net Position in the Interbank market M	
Credit Portfolio L	**Equity**
Investment INV	E

Note: α represents the percentage of deposits and liabilities that banks must establish as a reserve at the Central Bank.
Source: Prepared by authors.

$$\max_{L,D} \ \pi(D,L) = r_{L,ex\,post}L + r_{INV}\,INV + rM - r_D(D) - r_E E - C(D,L) \quad (1)$$

$$M = (1-\alpha)D + E - L - INV \quad (2)$$

$$E = (CAR)(RWA)(L) \quad (3)$$

$$INV = \left[\frac{D(1-\alpha)^2}{2}\right] * FR \quad (4)$$

Where $r_{L,ex\,post}$, r_D, r_{INV} and r_E represent the cost or yield from credit, deposit, investment and equity operations, respectively, and *r* is the monetary policy rate (TPM), $C(D,L)$ are the administrative and labor costs (GAL) of granting credit or taking deposits, CAR is the capital adequacy ratio, RWA is the risk weighted assets associated with the credit portfolio, given the solvency ratio, and FR is the withdrawal factor the institution may experience with respect to its deposits.

The first-order conditions of this problem (CPO) establish the relationship between the interest rates intermediaries would accept under perfect competition and the costs associated with granting credit and taking deposits (equations 5 and 6). Specifically, γ_L and γ_D are the parameters that pertain to the marginal operating cost of granting a new loan and deposits, in that order.

$$\frac{\partial \pi}{\partial L} = 0 \rightarrow r^P_{L,\,ex\,post} = r + \gamma_L + (r_E - r)(CAR)(RWA) \quad (5)$$

$$\frac{\partial \pi}{\partial D} = 0 \rightarrow r^P_D = (r_{INV} - r)\frac{(1-\alpha)^2}{2}(FR) + r(1-\alpha) - \gamma_D \quad (6)$$

The exercise consists of using balance sheet information to calibrate each of the *CPO* parameters and, in doing so, to obtain a calibration of the theoretical interest rates under perfect competition ($r^P_{L,\,ex\,post}$ and r^P_D). In parallel, the observed implicit interest rates are calculated from the banks' balance sheets (equations 7 and 8).

$$r_{L,ex\,post} = \frac{Interest\ Income}{L} \quad (7)$$

$$r_D = \frac{Interest\ Outflows}{D} \quad (8)$$

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1 A general description of the model can be found in Freixas and Rochet (1998).

2 The level of investments set by the institution must be in line with the maximum possible withdrawal it can face (FR), assuming such withdrawals follow a uniform distribution; i.e., that $INV = FR \times D \times E[0, max(0, \tilde{x} - \alpha)]$ with $\tilde{x} \sim U(0,1)$.

Once the theoretical interest rates under perfect competition have been calibrated and the implicit interest rates calculated, the observed ($MI_{ex\text{-}post}$) is broken down into the theoretical components associated with perfect competition and an error term (equation 9). This does not imply the exercise assumes the loan market operates under perfect competition, but that it uses the interest rate approximation under this competitive structure to relegate to the error term all those elements that cause a difference between the implicit rates that are found, and the theoretical approximation being used, including the market structure. Therefore, the error term can be understood as the conjunction of the market power of the banks, the differences in loan portfolio composition and the business structure in each jurisdiction, among other factors not explicitly modeled. Consequently, the *observed ex* – post margin can be written as the sum of the theoretical margin and the error term (ϵ):

$$MI_{ex\ post} = r_{L,ex\ post} - r_D = r^{P}_{L,ex\ post} - r^{P}_{D} + \epsilon \qquad (9)$$

Using the CPOs, the observed *ex-post* margin can be broken down as follows:

$$MI_{ex\text{-}post} = \underbrace{(r)}_{MPR} + \underbrace{(y_L + Y_D)}_{GAL} + \underbrace{((r_E - r)\,(CAR)\,(RWA))}_{Capital\ Cost} - \underbrace{\left((r_{INV} - r)\,\frac{(1-\alpha)^2}{2}\,(FR)\right)}_{Liquidity\ Risk} + \underbrace{(\alpha r)}_{Reserve\ Requirement} + \underbrace{\epsilon}_{Error}$$

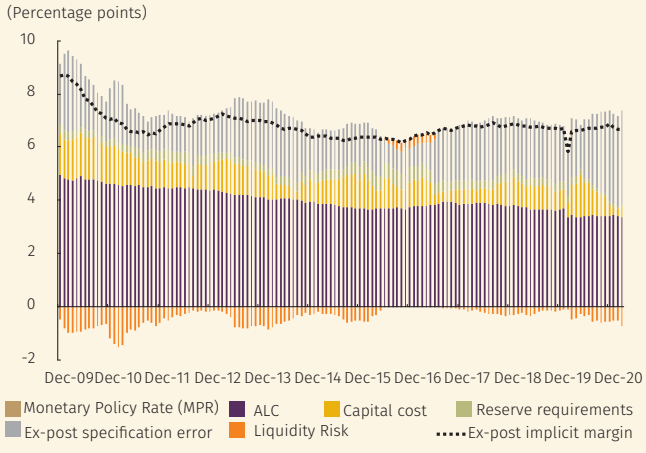
Where, the term MPR corresponds to the monetary policy rate and GAL, to the operating costs of granting a new loan and deposit-taking operations. The cost of capital refers to the cost derived from the need for institutions to have sources of funding other than deposits, given the solvency requirement. Liquidity risk refers to the cost associated with maintaining investment reserves to deal with possible withdrawals or to meet short-term obligations, while the reserve requirement refers to the cost of maintaining deposits as a reserve at *Banco de la República*.

Graph B1.1 shows the results of this exercise for Chile and Colombia. They suggest ex-post intermediation margins have remained stable in recent years (at around 7% in Colombia and 4% in Chile) and that a large part of the difference in size between these margins can be attributed to labor and administrative costs. Finally, the unexplained component of the ex-post margin is relatively larger in Chile than in Colombia.

The observation that emerges with respect to the high share of bank operating costs has been a constant in studies that have broken down the intermediation margin using different empirical approaches and other periods of analysis.[3]

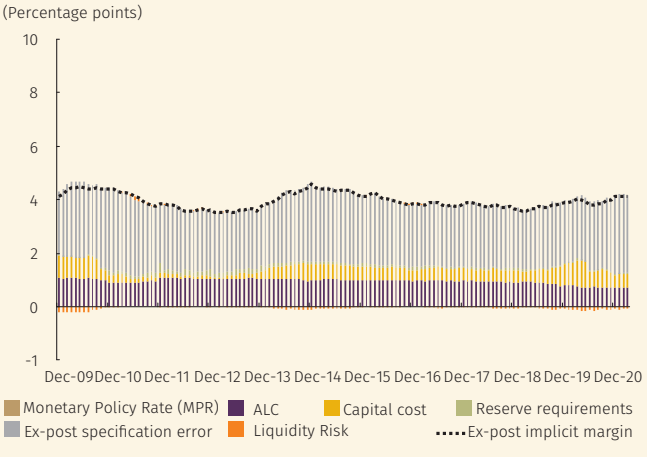
Graph B1.1
Breakdown of Intermediation Margin

A. Colombia



Source: *Office of the Financial Superintendent of Colombia*, calculations by authors.

B. Chile



Source: Financial Market Commission of Chile, authors' calculations

References

Estrada, D.; Gómez, E.; Orozco, I. P. (2007). "Determinantes del margen de intermediación en Colombia," In-house document, *Banco de la República*.

Freixas, X.; Rochet, J. C. (1998). Microeconomics of Banking, Cambridge, Massachussetts: MIT Press.

Steiner, R.; Barajas, A.; Salazar, N. (1997). "El margen de intermediación bancaria en Colombia," In-house document, *Banco de la República*.

Urrutia, M. (2000). "El margen de intermediación y la importancia de su medición," *Revista del Banco de la República*, vol. 73, no. 871, May.

3 Steiner, S., Barajas, A. and Salazar, N. (1997), Urrutia, M. (2000) and Estrada, D., Gómez, E. and Orozco, I. (2007).