Box 1

The Transmission of Changes in the Monetary Policy Interest Rate (MPR) to Credit Institutions' Interest Rates (CI)

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The mechanisms through which monetary policy actions affect the short-term economic growth and inflation are called the channels of monetary policy transmission. One of them, the interest rate channel, implies that changes in the MPR (short term) are transmitted to the interest rates with similar and longer terms for the different financial instruments. These changes modify the cost of financing for various economic agents, alter their spending and investment decisions and, as a result, affect the economic activity, the exchange rate, the inflation expectations and, finally, the prices. In this context, the efficiency of this channel depends on both the degree of sensitivity of short, medium, and long-term rates to changes in the MPR and the time it takes for this sensitivity, along with other factors, to materialize.

The above mechanism is reinforced when the credit channel works. The latter channel has an effect when bank loans are a special or single source of financing for agents[1], and when, for commercial banks, loans cannot easily be replaced by other investments either. Under these circumstances, changes in the MPR alter the general level of the interest rates and affect the supply of bank loans in the economy. As a result, the impact of such changes on the interest rates for loans is reinforced as is their effect on aggregate demand and, therefore, prices.

Despite the above, the transmission of the changes in the MPR to deposit and loan interest rates is not immediate and has a high degree of uncertainty. In this Box, we show some results which suggest that compared to observed since 2003, the speed of adjustment of the interest rates to changes in the MPR in the period (April to December 2020) has been faster, particularly to interest rates on deposits and preferential loans. First, we describe the main aspects of the transmission of the MPR to market interest rates, and how the performance of some variables that affect the savings and loan markets generates uncertainty in estimating the MPR. Also, we argue why the transmission of the MPR may be asymmetric, i.e., its degree or speed may differ in periods when the MPR increases or decreases.

1. Some Factors that affect the Transmission of the MPR

a. The Situation of the Economy and the Characteristics of CIs

The main function of CIs is to capture money from families and enterprises in an economy (surplus) and lend it to those agents who require it for consumption or investment (deficit). In this respect, the control and monitoring of the various risk factors by the CIs is intended to ensure the stability of these entities, a crucial factor in preserving household and corporate savings. Significant changes in economic activity or very volatile periods affect the risk level that CIs perceive, therefore altering the operation of the credit channel and the transmission of the MPR. For example, sharp output declines are often accompanied by reductions in credit demand and supply, liquidity problems or increases in financing costs by CIs, declines in the agents' income, and increases in credit risk, among others. In such a context, the accumulation of risks in CIs is transferred to interest rates on loans and slows down the transmission of reductions in the MPR. This slow or scarce transmission can also occur in periods of economic boom and TPM increases, particularly when they coincide with increases in credit supply far above demand.

The micro-financial characteristics of CIs could also explain different reactions of savings and credit rates to changes in the MPR. In general, small and low-capital or liquidity CIs face greater restrictions in their access to resources, and their rates tend to show lower sensitivity to movements in the MPR, particularly during periods of interest-rate cuts.

Chavarro et al.(2015) used duration and cross-sectional models to assess the effect of macro-financial and micro-financial variables on the transmission of the MPR. In the first case, the duration model evaluates the likelihood of transmission occurring at 25%, 50%, 75%, and 100%, and estimates the impact of macroeconomic and micro-financial factors on this probability. The authors found that increases in positive gaps of both inflation and output decrease the likelihood of transmission taking place in commercial credits. In addition, they found that the effect of the micro factor was negative, small,

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1 In 2019, 55.6% of corporate financing in national (N) and foreign (F) currencies was made through loans with CIs, 23.8% through N or F suppliers, 13.9% through parent companies, and 7.8% with bonds. As for households, 93.3% of financing is provided by CIs and the remaining 6.7% by cooperative institutions, employee funds, and mutual associations.

and with limited significance for the credit modalities analyzed. Using a cross-sectional, feasible generalized least squares model (FGLS), they studied the individual effect of the size, liquidity, and capitalization of CIs on the transmission of the MPR to consumption, commercial, ordinary, and preferential credits (Table B1.1). The main results are: 1) In the long term, transmission to interest rates of all modalities is complete; 2) Regarding consumer credits, the size of CIs is the only factor that affects transmission (larger entities record a greater transmission); 3) As for preferential credits, CIs with the highest capitalization level reacted most to the change in the MPR; and 4), liquidity makes no difference in transmission for any of the credit modalities. Larger entities have lower rates for ordinary and consumer credits. Liquidity positively impacts the rate level for ordinary credits, while this characteristic has no significant effect for other modalities.

b. Limits on Credit Interest Rates

In principle, limits on credit interest rates seek to protect consumers from an excessive rate or usury rate. However, critics of these limits argue that, as they do not result from an optimal balance between credit supply and demand, they can generate several adverse effects, such as less financial deepening, informality in the high-risk loan market[2], and rigidities in the transmission of the MPR to credit rates, among others. A statistical exercise for Colombia shows the effect of the limit rates and the MPR on interest rate dynamics for different credit terms and modalities. Graph B1.1 shows the percentage of the variance of the corresponding market rate explained by the MPR and the limit rate (partial R^2). A significant effect of the movements of the limit rate on micro-credit, credit card loan, mortgage, and consumer lending rates (for less than three years) were found[3]. On the contrary, in commercial credits, the influence of usury rates is very low and considerably less than the contribution of the MPR[4].

c. Expectations and Unanticipated Changes of the MPR

Theoretically, long-term interest rates can be expressed as an average of the expected short-term rates contained by the total maturity period of the loan or deposit. Thus, agents can modify the expected level of a market interest rate throughout the term horizon in the face of variations or expectations of changes in the MPR. In this regard, Cristiano *et al.* (2017) conducted several econometric exercises to include the effect of expectations on the transmission of the MPR. The first exercise assesses the effect of the non-anticipated component of changes in the MPR on the transmission of fixed-term deposits (DTF) and commercial (ordinary and preferential) rates. From October 2008 to December 2020, the effect of the unanticipated shock calculated through a Taylor rule (Ψ_t)[5] is significant only for preferential rates. In the unanticipated shock using the agents' expectations (Ψ'_t)[6], an unexpected decision is transmitted by 64.6% to the DTF rate, 76.9 % to preferential rates, and 61.7% to ordinary credit rates (Table B1.2).

Two other exercises focus on studying the effect of unanticipated shocks on short-term interest rates (ninety-day DTF or CDT). In the first, monthly changes in the DTF rate are expressed as a simple average of the changes in the agents' monthly MPR expectations, prediction errors, and prediction corrections[7]. The estimate for this model is updated with data to 2020. Results suggest that DTF rates are adjusted by 41.4% for the expected total change in the MPR month by month until its duration (expected change at three months). In contrast, the monetary surprises and corrections made by CIs to their forecasts do not have a statistically significant effect on the behavior of the DTF (Table B1.3). In the second exercise, by using daily data, the authors analyze the effect of monetary policy decisions on the change in interest rates to ninety days, breaking it up into three moments: one month's before, one day's before, and immediate (the next day). Results suggest that ninety-day CDT rates are adjusted by 63.4% one month prior to the BDBR's announcement, while the effects one day before the change and one day after the change are not significant (Table B1.4).

2. How long does Transmission of the MPR take?

The factors mentioned previously explain the lag between announcing a change of the MPR and its transmission to market interest rates. The duration of this transmission has been analyzed in several studies for Colombia, which have found a long-term relationship between the MPR and loan and deposit interest rates, but their transmission may be incomplete in the short term[8]. Overall, the estimated time for complete transmission is quite uncertain and implies a wide period. Factors like the duration of the period for increases or decreases, the magnitude of the changes, or the estimation methodologies affect the time required for transmission. Graph B1.2 shows the likelihood of a 50% or 100% transmission of the MPR changes to consumption, ordinary, and preferential rates. In both cases and for all modalities, the results suggest that market rates

2 Credit demand in high-risk loan markets, at rates higher than the usury rate, is usually met by unsurveilled agents.

3 Cointegration relationships between the market rate, the MPR, and the corresponding limit rate were found only for some credit card loan and micro-credit terms, as well as for some types of credit in the case of home acquisition. Long-term relationships between these rates were found for consumption and for ordinary and preferential interest rates.

4 For details of the methodology, see Chavarro *et al.* (2015).

5 The rule considers the output gap, the deviation of inflation from the target, US inflation, nominal depreciation, and the consumer confidence index: $TPM_t = f(GAP, (\pi\text{-}Meta), TPM, Inf_{usa}, \Delta TC, ICC)_{t-p} + \Psi_t$.

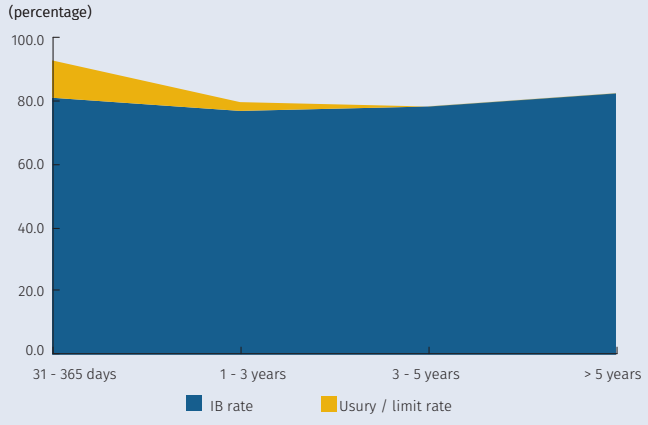
6 Using the results of the monthly expectations survey to economic analysts (EME), $\Psi'_t = TPM\text{-}E_{t-1}(TPM)$.

7 For details of the methodology, see Cristiano *et al.* (2017).

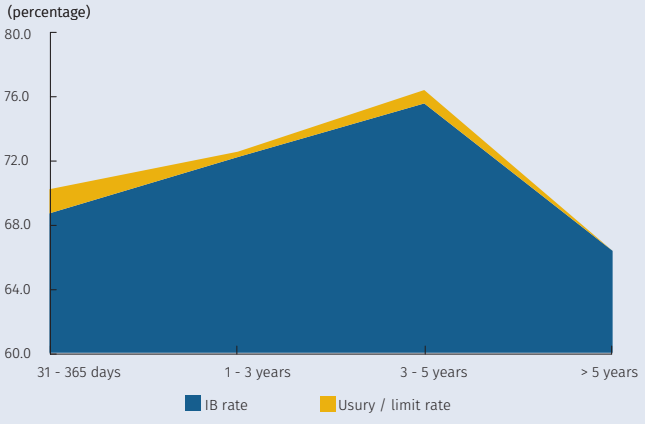
8 See Julio (2001), Huertas *et al.*(2005), Betancourt *et al.* (2006), Vargas *et al.* (2010), Chavarro *et al.* (2015).

Graph B1.1
Contribution of the Policy Rate and the User or Limit Rate to the Variation of Interest Rates by Credit Modality, Terms, and Type

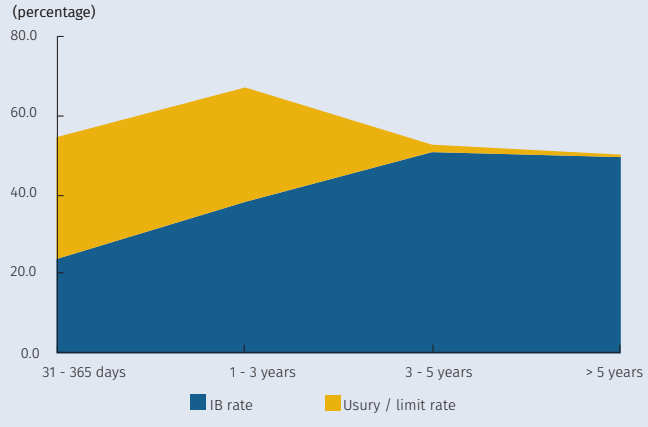
A. Preferential Rate



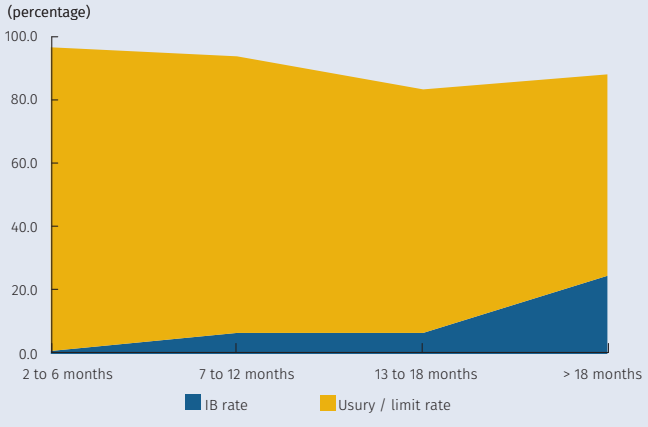
B. Ordinary



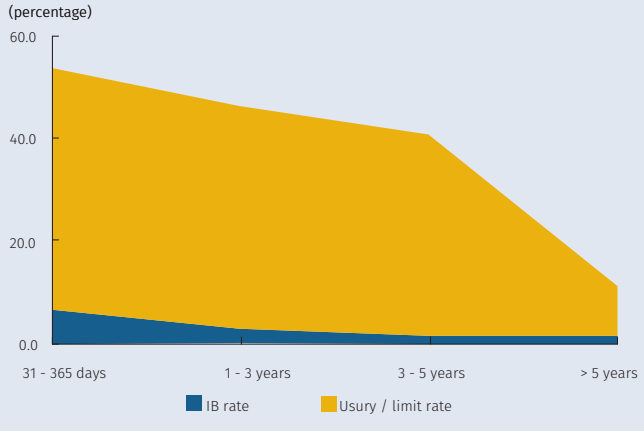
C. Consumption



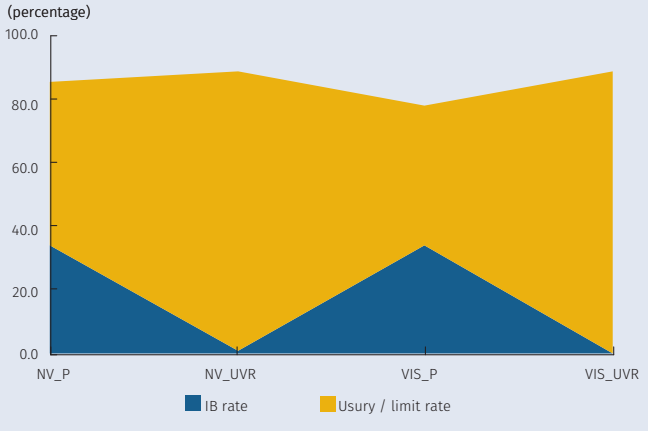
D. Credit Card[a/]



E. Micro-credit[a/]



F. Housing acquisition



NV_P: Housing acquisition (other than VIS) interest rate in pesos.
NV_UVR: Housing acquisition (other than VIS) interest rate in real value units (UVR).
Vis_P: Housing acquisition interest rate (VIS) in pesos.
VIS_UVR: Housing acquisition interest rate (VIS) in UVR.
a/ No stable long-term relationship was found between credit card and micro-credit rates with the Monetary Policy Rate (MPR) and the corresponding usury rate. Therefore, these results must be interpreted with caution.
Sources: Chavarro *et al.* (2015); Office of the Financial Superintendent of Colombia and *Banco de la República*; calculations by the authors; samples from May 2002 to December 2020.

Table B1.1
Estimated coefficients and control variables for IBR according to a FGLS model (2003-2020)

	Consumption	Ordinary	Preferential
Interactions			
IB*Size	1.896***		
IB*Capitalization			1.532***
Accumulated effect			
IB	1.015***	1.120***	1.006***
Size	-0.111***	-0.115***	0.040**
Capitalization	0.023**		-0.067
Liquidity		0.019**	0.002

Note: * Significant at 10%, ** Significant at 5.0%, *** Significant at 1.0%.
Sources: Office of the Financial Superintendent of Colombia and *Banco de la República*; authors' calculations; period analyzed: 2003 to 2020.

Table B1.2
Impact of the Unanticipated Shock on the MPR on Market Rates' Change

	Ψ Model	Ψ' Model
DTF	0.146	0.646***
Preferential	0.227*	0.769***
Ordinary	0.134	0.617***

Note: * Significant at 10%, ** Significant at 5.0%, *** Significant at 1.0%.
Sources: Office of the Financial Superintendent of Colombia and *Banco de la República*; calculations by the authors; period analyzed: October 2008 to December 2020.

Table B1.3
DTF: Effect of Unanticipated Shocks based on Short-Term Expectations.

	Coefficient
Surprise	0.042
Adjustment	0.197
Change expected at 3 months	0.414***

Note: * Significant at 10%, ** Significant at 5.0%, *** Significant at 1.0%.
Sources: Office of the Financial Superintendent of Colombia and *Banco de la República*; calculations by the authors; period analyzed: October 2008 to December 2020.

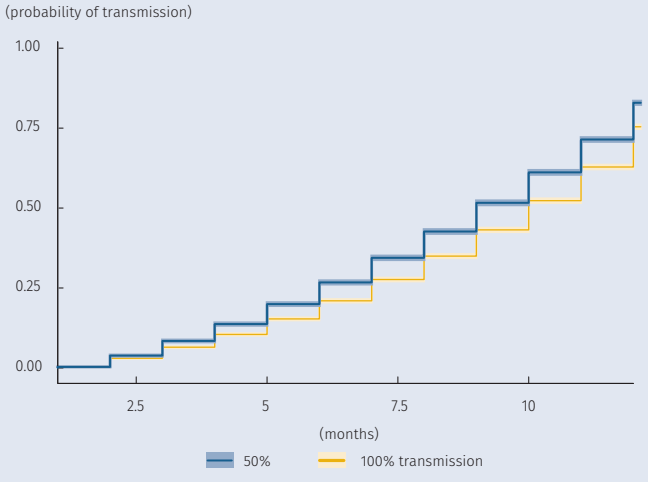
Table B1.4
CDT at 90 days: Effects of anticipated changes (one month before), one day before, and immediately.

	Coefficient
Anticipated	0.634***
One day before	-0.158*
Immediate	0.142
Total effect	0.619***

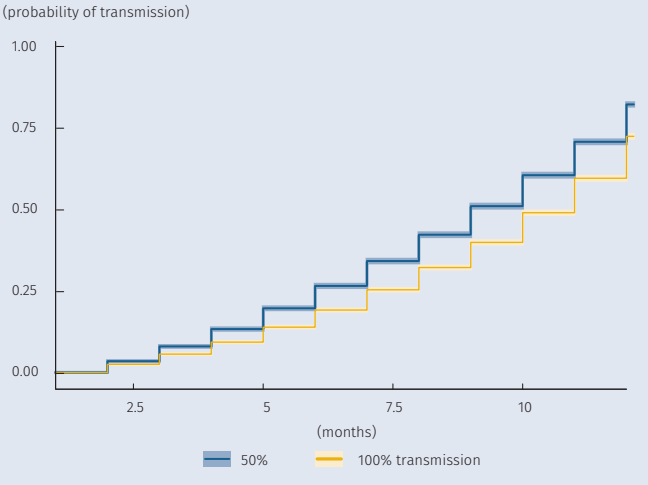
Note: *Significant at 10%, ** Significant at 5.0%, *** Significant at 1.0%.
Sources: Office of the Financial Superintendent of Colombia and *Banco de la República*; authors' calculations; period analyzed: 2003 to 2020.

Graph B1.2
Characterization of the 50% and 100% Transmission Probability of the Change to the MPR to Market Rates

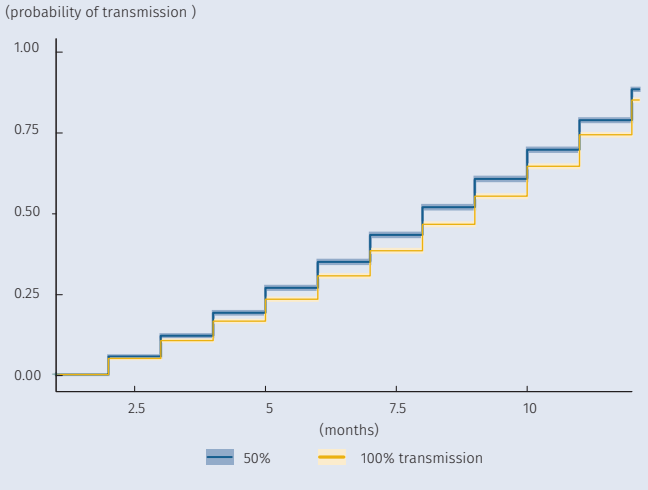
A. Consumption



B . Ordinary



C. Preferential credit



Sources: Office of the Financial Superintendent of Colombia and *Banco de la República*; authors' calculations; period analyzed: 2003 to 2020.

require some time to fully absorb the MPR shocks. The highest probability of transmission to preferential rates stands out, with a similar probability in the two scenarios, 50% and 100% transmission.

Another descriptive way to analyze the transmission is considering the *sensitivity index* [9], which contrasts, for each period of increase or decrease of the MPR, the cumulative change of a market rate vis-à-vis the cumulative change of the MPR. In this way, the time required by financial institutions to transmit the MPR stance in each complete scenario of increases or reductions is analyzed, as well as the magnitude of the adjustments regarding changes in the MPR and the credit modalities that exhibit greater and lesser reactions[10]. The results for 2003 - 2020 show that transmission takes time and that it differs for different modalities. In this period, to reach 90% sensitivity, the CDT rates require, on average, about a year and a half, and transmission is faster toward captures made by treasuries than those made by offices (Table B1.5). As for loan rates, the average and the standard deviation of the indicator suggest that the modalities that first reach 90% of transmission with less uncertainty are, in order, the interest rates for preferential, ordinary, consumption, micro-credit, and housing credits. Results also suggest that in the last phase of MPR reductions, from April to December 2020, transmission to deposit interest rates (seven months) and preferential credits (six months) has been faster than its historical average. At the end of 2020, the other modalities also exhibited good sensitivity: ordinary (84%), consumption (67%), and mortgage (35%) (Graph B1.3).

Galindo et al. (2020) assess the long- and short-term relationship between the MPR and market rates. They found that transmission to deposit rates can take about a year and a half, while for loan rates, between one and a little over two years, depending on the modality. Within the latter, transmission to commercial rates (preferential and ordinary) is usually at the bottom of that range, and consumption rates at the top. The slowest to react are micro-credit and housing interest rates. Analyzing the duration of the transmission of the MPR, they found that 90% transmission of a change in the MPR: 1) is almost complete in deposit rates and takes about 11 months; 2) is complete for the aggregated loan interest rates and requires about 17 months; and 3) exhibits a faster transmission to preferential and ordinary commercial interest rates (14 months) 23 months, respectively), for consumption interest rates it takes 34 months.

3. Is MPR Transmission Symmetrical?

Several studies have found differences in transmission and pace of adjustment of market rates facing reductions or increases in the MPR. For example, when analyzing data from OECD countries, Borio and Fritz (1995) found that market rate adjustment is slower in response to the reduction of the MPR compared to an increase. One argument for this to happen is that during recessions, the risk and credit requirements increase, and loan applicants turn to bidders with whom they have closer relationships. In this context, a reduction in the MPR leads to a minor balance adjustment of market interest rates. Asymmetry in transmission may occur in the opposite direction due to adverse selection problems and asymmetries of information in the credit market. In such cases, to avoid an increase in credit risk, CIs may decide not to fully transmit the increase in the MPR to their clients, as this could increase the likelihood of default and deteriorate the quality of their portfolios. This problem would materialize when there are increases in rates, but not when there are reductions. Additionally, De Bondt (2005) found that increasing the market rate in competitive markets can lead to customer losses in favor of competitors and be reflected in interest rate rigidities. In practice, both types of asymmetry can take place in an economy and may be different for distinct deposit and loan interest rates.

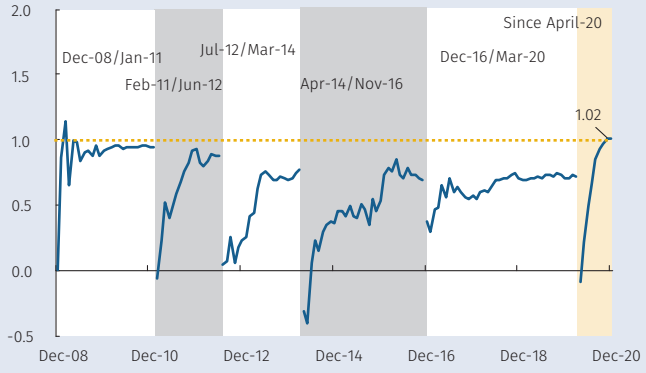
Galindo et al. (2020) used the methodology proposed by Shin (2014) to simultaneously estimate for Colombia short- and long-term asymmetries based on a cointegration scheme, using a non-linear autoregressive distributed lag model (NARDL). From May 2002 to August 2020, the authors found some asymmetries in the long term but not in the short time. In particular, they found symmetry in the response of the aggregate loan rate and the one for preferential commercial credits. On the other hand, consumer and ordinary credit rates react more to reductions in the MPR than to increases. Deposit interest rates respond more to increases than to decreases of the MPR. Thus, these results suggest that monetary policy could be more effective when it is expansionary than contractionary.

9 For details of the methodology, see Chavarro *et al.* (2015).

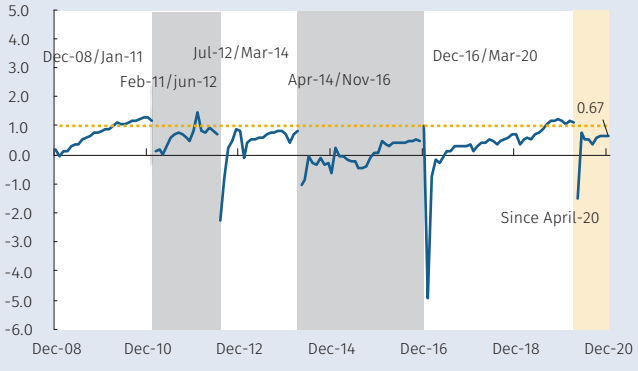
10 Negative values suggest a contrary sensitivity; between 0 and 1, low sensitivity (less than proportional); equal to 1, complete transmission; greater than 1 suggests a high sensitivity (more than proportional).

Graph B1.3
Market Interest Rate Sensitivity Index vis-à-vis the MPR

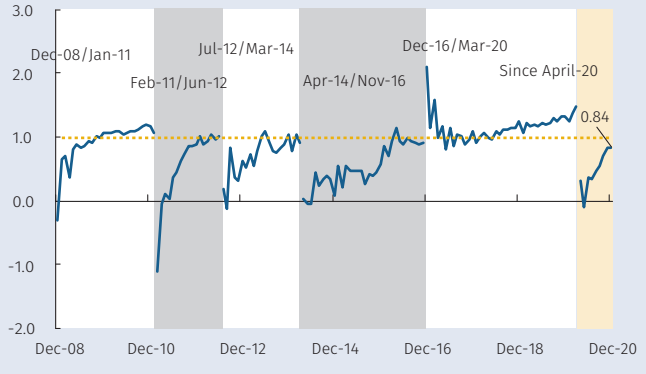
A. DTF Rate



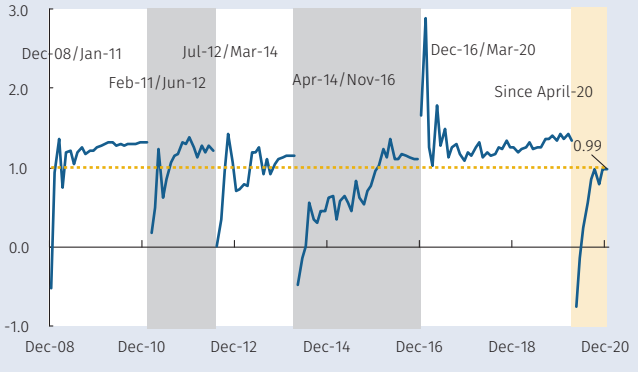
B. Consumption



C. Ordinary



D. Preferential Rate



Note: The sensitivity index (SI) is the cumulative change of a market rate as a proportion of the cumulative change in the MPR for each period of increase or decrease in the MPR. AN SI<0 means an anti-MPR reaction; 0<SI< 1, low MPR sensitivity (less than proportional); SI=1, full TPM transmission; SI>1, high TPM sensitivity (more than proportional). White stripes correspond to periods of reduction in the MPR; gray, to increases in the MPR; and yellow, to the last phase of reduction in the MPR (April to December 2020).
Sources: Office of the Financial Superintendent of Colombia and *Banco de la República*; authors' calculations.

Table B1.5
Savings and Credit Rates Sensitivity Index to Changes in the MPR

Type	Modality	Average months to reach 90% of change		
		April/2020 to Dec/2020	Jan/2003 to Dec/2020	
			Average	Standard Deviation
Deposits	Total CDT	7	17	11
	CDT < 6 months	5	19	11
	DTF (3 months)	5	18	11
	CDT from 6 to 12 months	5	18	10
	CDT > 12 months	4	8	8
	Treasury CDT	4	9	7
	Branch office CDT	7	22	10
Household placements	Consumption	*	17	10
	Mortgage (Non VIS)	*	20	12
	Credit card	1 **	15	8
Corporate placements	Ordinary	*	13	9
	Preferential	6	8	7
	Microcredit	1 **	17	11
	Non-VIS housing construction	*	16	9

* 90% not reached
** In these cases, the reaction is explained by the effects of rate recomposition rather than by rapid transmission of the MPR. In that regard, it should be considered as an atypical fact.
Sources: Office of the Financial Superintendent of Colombia and *Banco de la República*; authors' calculations; period analyzed: 2003 to 2020.

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