

## Box 2 ELASTICITIES IN EXCHANGE RATE PASS-THROUGH TO PRICES

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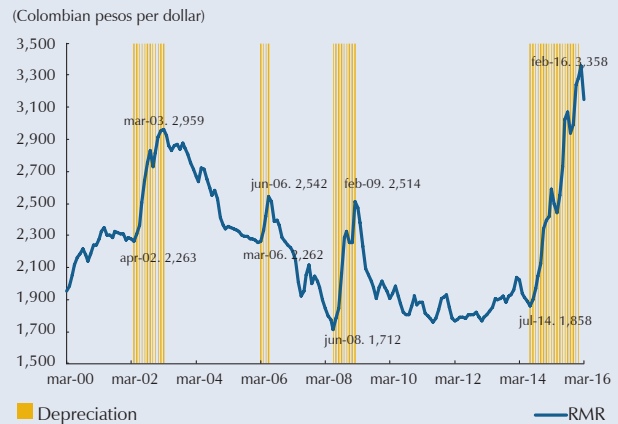
Monetary policy in Colombia is governed by an inflation targeting scheme designed to keep the rate of inflation low and stable. For this reason, it is important to measure and understand how prices in the economy respond to fluctuations in the exchange rate, an effect known in economic literature as pass-through (PT). Annual consumer inflation trended sharply upward during 2015 and in 2016 to date, reaching in 7.98% by March 2016. This was due to a variety of variables, one of which is the considerable extent to which the peso has depreciated against the dollar since July 2014. This trend peaked in February 2016, when the monthly average exchange rate was COP 3,357.5 per dollar.

The purpose of this box is to show how the various price indicators in Colombia have evolved during the different periods of depreciation since the year 2000 and to draw a comparison. Based on the information obtained, the authors offer an approximation of the degree to which the bilateral exchange rate (with the dollar US) and the multilateral rate (calculated with the currencies of our main trading partners) have passed through to several indexes; namely, the prices of imports goods (IP), the imported producer price index (imported PPI) and the consumer price index for tradables (tradable CPI). It is important to point out that the PT calculated for this article is limited and quite simple, as it is not intended to be a precise estimate of the lag in the time it takes the exchange rate to pass through to prices, nor is it controlled by the state of the economy or intended to identify the degree of asymmetry between periods of depreciation and appreciation.

The method used by the authors to estimate the degree of PT consists of calculating a simple elasticity between the accumulated change in each price indicator and the bilateral or multilateral exchange rate for the four depreciation periods that have occurred since 2000 (Graph B2.1). The initial value for each series is the first month of each phase of depreciation, and the final month is the ceiling reached by the exchange rate and by each price variable that is taken into account. It is important to clarify that the

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Graph B2.1  
Periods of RMR Depreciation in Colombia (monthly average) (2000-2016)



Sources: Financial Superintendence of Colombia and calculations by Banco de la República

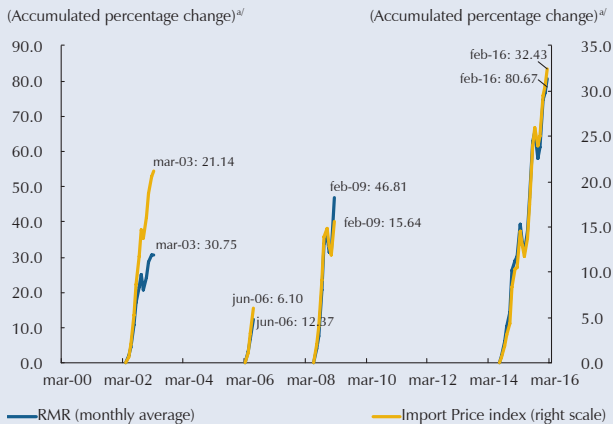
peak of the exchange rate in each phase of depreciation does not necessarily coincide with the ceiling of the price variable being compared. The tradable CPI is a case in point; its maximum value invariably was reached several months after the ceiling for the exchange rate, given the lag with which PT operates.

### 1. Prices of Imported Goods (IP)<sup>1</sup>

As shown in Graph B2.2, the changes in prices for imported goods adjusted quickly and without delay to fluctuations in the representative market rate of exchange (TRM) during all the periods studied. The bilateral exchange rate elasticity of import prices in April 2002-March 2003, when it was highest, closed at 68.8%. In contrast, during June 2008-February 2009, at its lowest, it was 33.4%. In the current period of depreciation, elasticity (40.2%) is higher than in the third period, but lower than during the first (Graph B2.3).

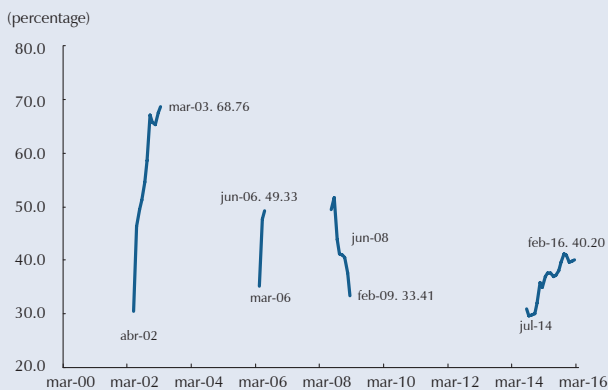
<sup>1</sup> The terms of trade index is defined as the ratio of the export price index (PX) to the import price index (IP). This last price variable was used, as it offers the advantage of having broad coverage because it includes a high percentage of the transactions that are carried out. For further details see, "Metodología de cálculo de los índices de precios de exportaciones, importaciones y términos de intercambio según los índices de precios del productor (IPP)". Available in: [http://www.banrep.gov.co/sites/default/files/paginas/Nota\\_metodologica\\_terminos\\_intercambio\\_comercio\\_exterior.pdf](http://www.banrep.gov.co/sites/default/files/paginas/Nota_metodologica_terminos_intercambio_comercio_exterior.pdf)

**Graph B2.2**  
RMR: Prices of Imported Goods



a/ The change from the start of the period of depreciation up to the maximum value registered for the RMR and the price index for imported goods.  
Sources: : Financial Superintendence of Colombia and DANE; calculations by Banco de la República

**Graph B2.3**  
Elasticity<sup>a/</sup> RMR: Prices of Imported Goods



a/ Accumulated change in PI (%) / Accumulated change in the RMR (%)  
Sources: Financial Superintendence of Colombia and DANE; calculations by Banco de la República

The pass-through of the multilateral exchange rate to import prices has been greater than the pass-through calculated with the bilateral exchange rate in the depreciation periods from April 2002 to March 2003 (98.42%), June 2008 to February 2009 (55.41%) and July 2014 to February 2016 (55.43%). Between March 2006 and June 2006, the elasticity of the multilateral exchange rate (49.0%) and the bilateral exchange rate (49.3%) tended to be similar (Table B2.1).

## 2. Imported PPI

As with import prices, the pass-through of changes in the bilateral exchange rate to changes in the imported PPI was the highest during the episode of depreciation between April 2002 and March 2003 (72.3%). The lowest occurred during the episode from June 2008 to March

2009 (32.9%). In the current depreciation period up to February 2016, elasticity stands at 38.0% (Graph B2.5). It should be noted that, in general, both the bilateral and multilateral elasticities of the prices of imported goods are close to those of the imported PPI. This last index also adjusts quickly to changes in the RMR, with no significant lag (Table B2.1).

## 3. Tradable CPI

As with the other price indicators studied, the degree of pass-through to the tradable CPI is higher in the case of the multilateral exchange rate than what was observed with the bilateral exchange rate during the periods in question, except for the episode of depreciation between March and June 2006, when the elasticities were similar.

During the period with the highest elasticity of bilateral exchange rate pass-through to prices for consumer tradables (2002-2003), once the RMR reached its peak in March 2003 (COP 2959.01), the response from the tradable CPI extends for more than a year, up until June 2004 (Graph B2.6). This is important to note.

In the current episode of depreciation, the elasticity of the tradable CPI to fluctuations in the bilateral exchange rate came to 15.0%. This is far less than the level observed for the period from April 2002 to June 2004, when it was highest (55.2%). However, it surpassed the extent observed between June 2008 and April 2009, when it was lowest (7.5%) and is somewhat less than the elasticity of 17.6% calculated for the depreciation period in 2006 (Graph B2.7).

The main findings were the following:

- The pass-through of exchange rate fluctuations to prices for imported goods and the imported PPI is greater than pass-through to the tradable CPI. This suggests that the longer the marketing chain, the more exchange rate pass-through to prices tends to dilute.
- In the case of the index of import prices obtained from terms of trade and the imported PPI, fluctuations in the exchange rate tend to pass through immediately. This does not happen with the tradable CPI, which tends to adjust with a lag of one quarter or more.
- In general, bilateral exchange rate pass-through was observed as being less than multilateral exchange rate pass-through. The only exception was the episode of depreciation that occurred between March and June 2006, when the figures were similar.
- The extent of pass-through is different in each episode of depreciation, and this depends on the intensity and duration of peso depreciation and the state of the economy.

Table B2.1  
Pass-through Coefficients (Bilateral and Multilateral)

	Exchange Rate (ER)		Price Index for Imported Goods	Prices (P)	
	Bilateral ER <sup>b/</sup>	Multilateral ER <sup>c/</sup>		Imported PPI	Tradable CPI
Apr-02	2,263.11	127.08	88.30	84.55	72.07
Mar-03	2,959.01	154.38	106.97	103.34	
Jun-04					84.31
Accumulated change (percentage) <sup>a/</sup>	30.75 $a_1$	21.48 $a_2$	21.14	22.22	16.98
Elasticity	Bilateral ER $p/a_1$		68.76	72.27	55.24
	Multilateral ER $p/a_2$		98.42	103.45	79.06
Mar-06	2,262.36	126.99	102.29	98.52	88.24
Jun-06	2,542.24	142.80	108.53	104.54	
Sep-06					90.17
Accumulated change (percentage) <sup>a/</sup>	12.37 $b_1$	12.45 $b_2$	6.10	6.11	2.18
Elasticity	Bilateral ER $p/b_1$		49.33	49.39	17.61
	Multilateral ER $p/b_2$		49.02	49.08	17.50
Jun-08	1,712.28	103.34	88.12	86.77	97.70
Feb-09	2,513.74	132.50	101.90	99.99	
Mar-09				100.14	
Apr-09					101.13
Accumulated change (percentage) <sup>a/</sup>	46.81 $c_1$	28.22 $c_2$	15.64	15.41	3.52
Elasticity	Bilateral ER $p/c_1$		33.41	32.92	7.52
	Multilateral ER $p/c_2$		55.41	54.59	12.47
Jul-14	1,858.40	92.88	92.25	91.87	106.85
Feb-16	3,357.50	147.22	122.17	120.05	
Mar-16					119.74
Accumulated change (percentage) <sup>a/</sup>	80.67 $d_1$	58.50 $d_2$	32.43	30.67	12.06
	Bilateral ER $p/d_1$		40.20	38.03	14.95
	Multilateral ER $p/d_2$		55.43	52.43	20.62

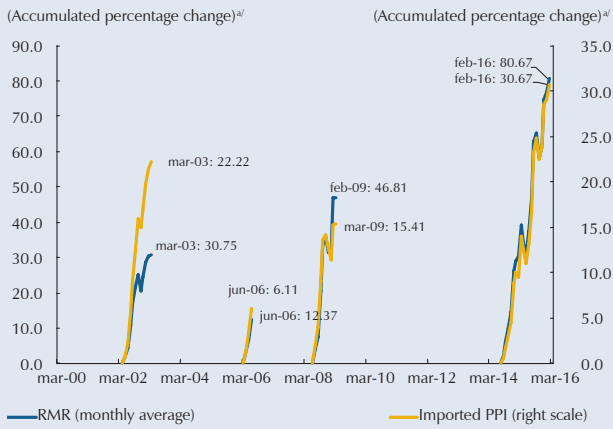
a/ Pertains to the change from the start of the initial period of devaluation up to the maximum value registered for the RMR (monthly average) and the index of each inflation indicator.

b/ Pertains to the representative market rate of exchange (RMR) (Colombian peso/US dollar).

c/ Pertains to the average nominal exchange rate for the Colombian peso (non-traditional trade weighted) with respect to the currencies of Colombia's major trading partners.

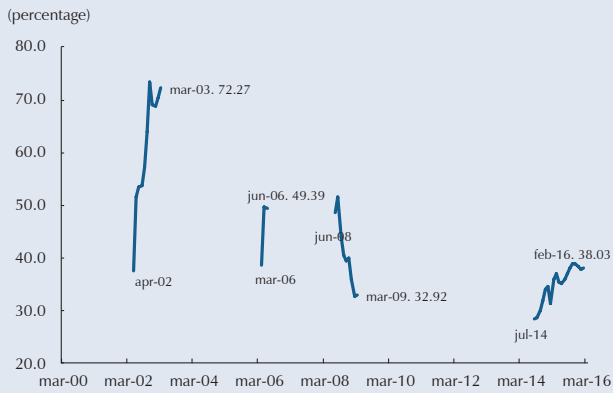
Sources: : Financial Superintendence of Colombia and DANE; calculations by Banco de la República.

**Graph B2.4**  
RMR – Imported PPI



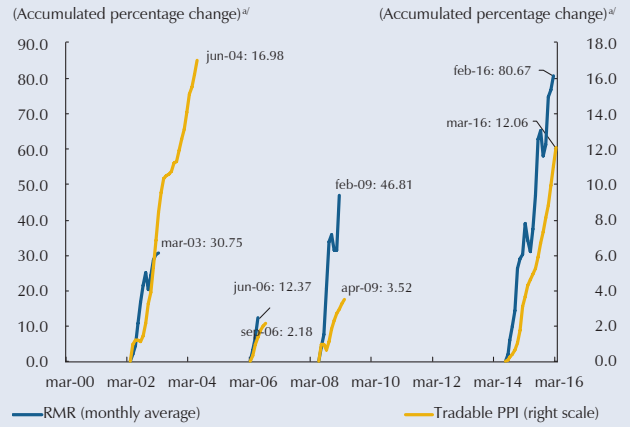
a/ The change from the start of the period of depreciation up to the maximum value registered for the RMR and the imported PPI.  
Sources: Financial Superintendence of Colombia and DANE; calculations by Banco de la República

**Graph B2.5**  
Elasticity<sup>a/</sup> RMR-Imported PPI



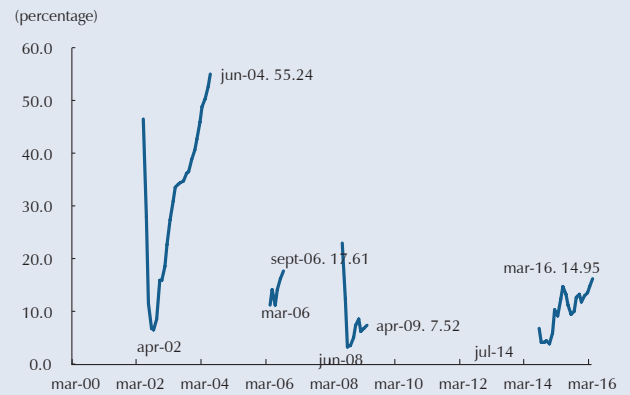
a/ Accumulated change in the imported PPI (%) / Accumulated change in the RMR (%)  
Sources: Financial Superintendence of Colombia and DANE; calculations by Banco de la República

**Graph B2.6**  
TRM-IPC Tradable



a/ The change from the start of the period of depreciation up to the maximum value registered for the RMR and the imported PPI.  
Sources: Financial Superintendence of Colombia and DANE; calculations by Banco de la República

**Graph B2.7**  
Elasticity<sup>a/</sup> RMR-Tradable CPI



a/ Accumulated change in the imported PPI (%) / Accumulated change in the RMR (%)  
Sources: Financial Superintendence of Colombia and DANE; calculations by Banco de la República