## New core inflation measures

This box assesses the recent evolution of core inflation traditionally monitored by the Banco Central do Brasil (BCB) and introduces two new measures, describing the methodology used in their elaboration.

Among cores regularly monitored by the BCB, the IPCA-EX0, IPCA-MS, and IPCA-MA were introduced between 2000 and 2003, while the publication of cores IPCA-EX1 and IPCA-DP began in 2009<sup>1,2</sup>. These measures seek to minimize the influence of higher volatility items on the aggregated indicator, with the aim of assessing the inflation trend without the effects of temporary shocks on prices behavior (Figure 1).



There is no consensual pattern in the literature about the ideal composition of an inflation core. Thus, a whole set of criteria has been used to assess the different cores<sup>3</sup>. As no individual core prevails over the others on all criteria, analysts usually monitor more than one core measure.

In this regard, the continuous evaluation of new core-building methodologies is part of the process of monitoring and analyzing current inflation. Both metrics presented hereafter expand the concept of the underlying inflation indicator for services<sup>4</sup>, by adding components of two other segments of inflation expressed in market prices: food-at-home and industrial goods.

3/ Please see discussion in Da Silva Filho & Figueiredo (2011).

<sup>1/</sup> In this box, the IPCA historical series have been used, after being recalculated with the POF 2009 weighting framework and ranking, implemented in January, 2012.

<sup>2/</sup> A more detailed history on the inclusion of cores in the BCB's documents may be found in the Work for Discussion 356 "Revisiting the Core Inflation Measures of the Banco Central do Brasil" from 2014, available at BCB's site (http://www.bcb.gov.br/pec/wps/ port/default.asp).O IPCA-EX0 core is obtained by the exclusion of the Food-at-home and Administered Prices groups. The IPCA-EX1 excludes 10 of 16 items from the Food-at-home group, besides items domestic fuels and vehicle fuels. The trimmed averages core (IPCA-MA) excludes items whose monthly changes stand, in the distribution, above the 80 percentile or below the 20 percentile. The remaining 60% are used to calculate the core monthly change. The smoothed trimmed averages indicator (IPCA-MS) follows the same procedure of the previous measure, with a difference: before eliminating tails, the components with infrequent changes are smoothed out. The double-weighting core (IPCA-DP) adjusts the original weights of each item in accordance with its relative volatility, a procedure that reduces the significance of more volatile components.

<sup>4/</sup> For additional information, see box "The services sector inflation", published in the September 2016 edition of the Inflation Report.

At first, an underlying indicator for industrial goods was obtained, by excluding the following items:

- Ethanol (representing 4.3% of the industrial goods weight<sup>5</sup>): a subitem that shows high price volatility and is significantly influenced by the supply conditions of inputs and substitute fuels;
- Cigarettes (4.7%): a subitem with few changes over the year, but whose prices are frequently affected by tax changes (taxes comprise about 80% of the product's final price); and
- New (11.6%) and used (4.0%) vehicles; electro-electronics (6.6%): subitems under heavy influence of tax administration policies, for example, the IPI tax relief policy in effect as of 2008 and the recomposition of rates since 2015.

Regarding the "food-at-home" group, only the less volatile items were kept: Baked goods (12,2%); Beverage and infusions (12,2%); Processed meat and fish (4,8%) and Canned and preserved goods (1,0%).

For the food-at-home group (Figure 2), underlying inflation shows lower volatility than the respective headline indicator, as expected. For industrial goods (Figure 3), inflation for the selected items is systematically higher than in the segment as a whole, reflecting the exclusion of vehicles and home appliances – which recorded relatively low inflation in the period. The underlying inflation indicator for services, however, shows an average closer to the sector's inflation as a whole and lower volatility in the monthly measures (Figure 4).



Sources: IBGE and BCB



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The selected items of services, industrial goods, and food-at-home are aggregated in the IPCA-EX2 core, comprising 57.6% of market prices and 42.9% of the Extended National Consumer Price Index (IPCA)<sup>6</sup> basket. A second core, the IPCA-EX3, aggregates only selected items from services and industrial goods, comprising 51.3% of market prices and 38.2% of the IPCA basket. While significantly different from the average of cores

<sup>5/</sup> The weights shown in this box are those from the May 2018 IPCA.

<sup>6/</sup> Excluded items represent 31.3% and 69.8% of the total weight of industrial goods and food-at-home in the IPCA, respectively. Regarding services inflation, the weight of the four groups eliminated corresponds to 37.6% of the sectorial IPCA inflation.

currently monitored by the BCB, the trajectories of IPCA-EX2 and IPCA-EX3 differ little between them, which may be attributed to the reduced weight of the remaining items of food-at-home.



Table 1 shows basic statistics for the seven inflation cores, using as the basis for comparison seasonally adjusted data and three-month moving averages<sup>7</sup>.

	Average			Standard deviation	MAE vs 12m centered MA <sup>2/</sup>		
	2006-2011 2	012-2017	2006-2017	2006-2017	2006-2011	2012-2017	2006-2017
IPCA	4.6	6.4	5.5	3.6	-	-	1.1
IPCA-EX0	4.4	6.0	5.2	1.9	1.0	1.2	1.1
IPCA-EX1	4.3	6.3	5.3	2.0	0.7	1.0	0.8
IPCA-DP	4.7	6.4	5.5	1.9	0.7	0.8	0.8
IPCA-MS	4.5	6.2	5.4	1.7	0.8	0.8	0.8
IPCA-MA	4.0	5.6	4.9	1.7	0.7	0.9	0.8
IPCA-EX2	5.7	6.5	6.1	2.1	1.4	1.1	1.2
IPCA-EX3	5.7	6.3	6.0	1.9	1.4	1.0	1.2

## Table 1 – Selected statistics of core inflation<sup>1/</sup>

Source: IBGE and BCB

1/ Standard deviation of the CPI calculated on its annualized monthly variation. For cores, the statistics are calculated on

quarterly moving averages seasonally adjusted and annualized.

2/ Mean absolute error in relation to the 12-month centered moving average of CPI.

In the 2006-2017 period, the IPCA-DP, IPCA-MS, and IPCA-EX1 recorded averages closer to the IPCA average. In line with results from previous studies, the IPCA-MA tends to underestimate the average change of headline inflation. From 2012 to 2017, the IPCA-EX3 and the IPCA-EX2 showed reduced deviation in relation to the IPCA average, but from 2006 to 2011 they showed a high bias, mostly due to the selection of components from the industrial goods group (Figure 3). More recently, the discrepancy of IPCA-EX2 and IPCA-EX3 in relation to the IPCA, however smaller, is due to the realignment of administered prices, especially domestic electricity rates. Thus, these cores minimized the effects of big temporary shocks.

Regarding volatility, the IPCA-MS and IPCA-MA were the cores showing lower standard-deviation in the 2006-2017 period, but all cores show significantly lower volatility when compared to the headline IPCA indicator.

In order to evaluate the adherence to the inflation trend, were calculated the mean absolute deviations in relation to a centered moving average of IPCA. According to this *criterium*, and considering the whole interval, the IPCA-DP, IPCA-MA and the IPCA-MS show the best statistics, followed by the IPCA-EX1.

<sup>7/</sup> Results do not change qualitatively when the seasonal adjustment is performed in real time.

Additionally, the cores were tested for their sensitivity to economic activity. Both in correlation tests (Figure 6)<sup>8</sup> and in econometric exercises including other variables as control, cores IPCA-EX2 and IPCA-EX3 showed greater adherence than the remaining cores to measures of the product gap. In this regard, the IPCA-EX2 and the IPCA-EX3 seem to include components more sensitive to the economic cycle, despite not highlighted in any of the previous criteria.



Regardless of methodological differences, all cores assessed in the current box indicate a process of significant fall in underlying inflation during 2016 and 2017. After stabilization in the second half of 2017, measures resumed indications of deceleration in the underlying inflation at the beginning of 2018. They now are in levels similar to or below to the inferior limit of the tolerance interval for the inflation target.

It is worth noting that the cores herein analyzed are part of a wide set of indicators that help conducting the monetary policy, without highlights for any specific measure.

8/ Figure 6 compares the simple correlations between each core and a measure of the product gap, considering 1 to 3 lags quarterly.