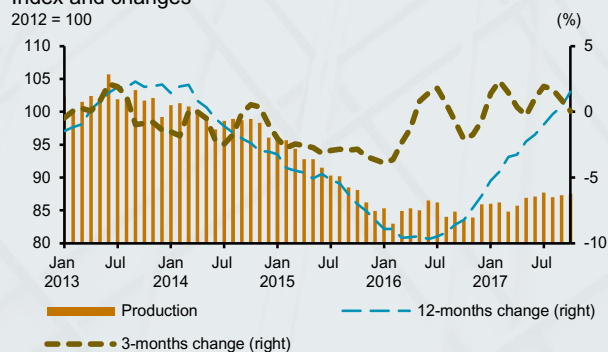


## 2017 industry growth analysis

**Figure 1 – General industrial production<sup>1/</sup>**  
Index and changes



The Brazilian industry has grown again in 2017, after three consecutive years of retraction. Industrial production accelerated steadily throughout the year and recorded positive accumulated twelve-month change as of September (Figure 1). The purpose of this box is to investigate the characteristics of this reversal in the dynamics of industry, including the degree of dissemination and the allocation of the increase of production.

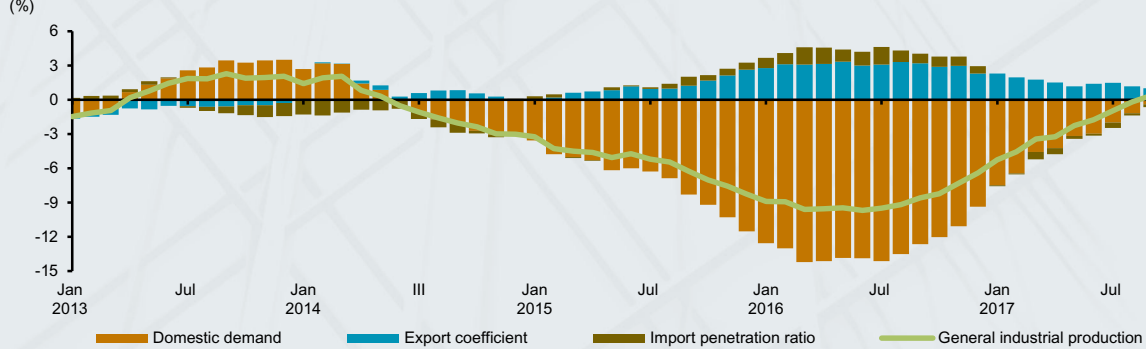
The change of industrial production was broken down into components related to changes in the domestic market, in the import penetration (IP) and in the export coefficient (EC)<sup>1/</sup>. The EC of a given sector was calculated as the ratio between the sector's export and production, at 2015 constant prices. Similarly, also at 2015 prices, import penetration<sup>2/</sup> was estimated as the ratio between imports and apparent consumption of industrial goods, the latter equals the sum of production with imports discounted from exports<sup>3/</sup>.

Industry output increased by 1.5 percent in the twelve-month period ended in October, chiefly because of the positive contributions of the EC (1.2 p.p.) and the domestic demand (0.9 p.p.), as observed in Figure 2. Of note, in this period, manufacture of

- 1/ Given the purpose of this box, the decomposition in terms of changes in export and import penetration coefficients is preferable to one relative to changes in their levels because, thus, the contribution of the external sector depends on their participation gains.
- 2/ The calculating methodology of the two indices is described in more detail in the box "Evolution of Manufacturing Industry Import and Export Coefficients" in the June 2016 Inflation Report. However, as the purpose of this box is to analyze the performance measured by the Monthly Industrial Survey (PIM), the calculation was modified so that the result is consistent with the changes of the PIM. First, imports and exports weights related to the value produced by each division of Industry are based on the 2015 data from the Resource and Usage Table (RUT) of the Brazilian Institute of Geography and Statistics (IBGE). Besides, the industry indexes were calculated as the aggregation of industry divisions indexes using PIM weights.
- 3/ Since production cannot be written as a linear function of the exports and import penetration coefficients, the relative share of each variable in the total derivative of production in relation to time was used, making the decomposition a linear function of the change in each of them. For that reason, the equality between supply and demand of the products of the industry was initially considered,  $Y_t + M_t = C_t + X_t$ , where  $Y_t$  is the industry production in the month  $t$ ,  $M_t$  and  $X_t$  represent the industry's typical products imports and exports and  $C_t$  is the internal absorption, including internal consumption and inventories changes. Rewriting imports and exports on the basis of import penetration and the exports coefficient, the equation can be rewritten as  $Y_t = C_t(1 - m_t)/(1 - x_t)$ . Thus assuming by simplicity that the processes are continuous and adopting the notation  $\dot{Z}_t = \partial Z_t / \partial t$  for any variable  $Z_t$  the total production derivative in terms of time is given by:  $\dot{Y}_t / Y_t = ((1 - m_t)/(1 - x_t))(C_t / Y_t) \dot{C}_t / C_t + ((1 - m_t)(C_t / Y_t)/(1 - x_t)^2) \dot{x}_t - ((C_t / Y_t)/(1 - x_t)) \dot{m}_t$ , where the three terms of the summation on the right-hand side of the equation are defined as the domestic demand contributions, the exports coefficient and the import penetration coefficient, respectively, for the production change. Calculations were made considering the average point between the instants  $t$  and  $t + 1$  for each variable, with the change contribution in the internal absorption calculated by residue.

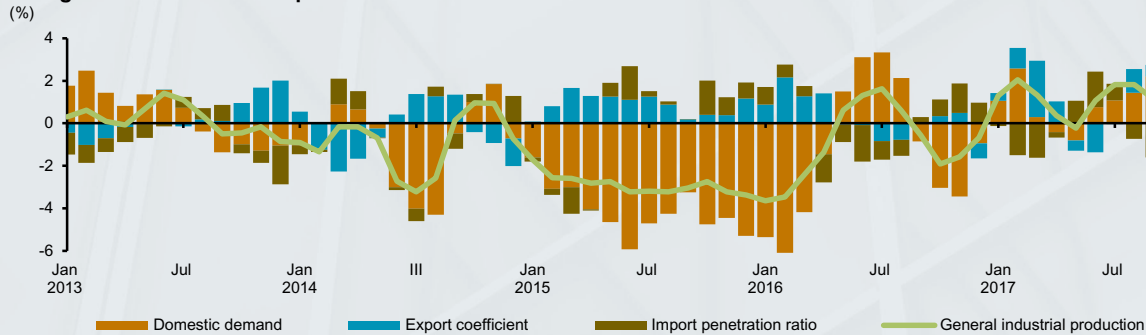
automotive vehicle, benefiting from improvements in domestic demand and in export coefficient, and the extractive industry, with emphasis on the impact of increased participation of the respective export.

**Figure 2 – Decomposition of 12-month accumulated change – General industrial production**



Domestic demand was the main vector QoQ of the industry growth, with a positive contribution of 2.5 p.p. for the 0.5 percent change registered in the quarter ended in October, mainly because of the performance of vehicle, chemicals and refining sectors. The IP increased in the period, contributing negatively to the performance of the industry, especially in the segments of machines and equipment, pharmachemicals and pharmaceuticals (Figure 3).

**Figure 3 – Decomposition of 3-month accumulated change – General industrial production<sup>1/</sup>**

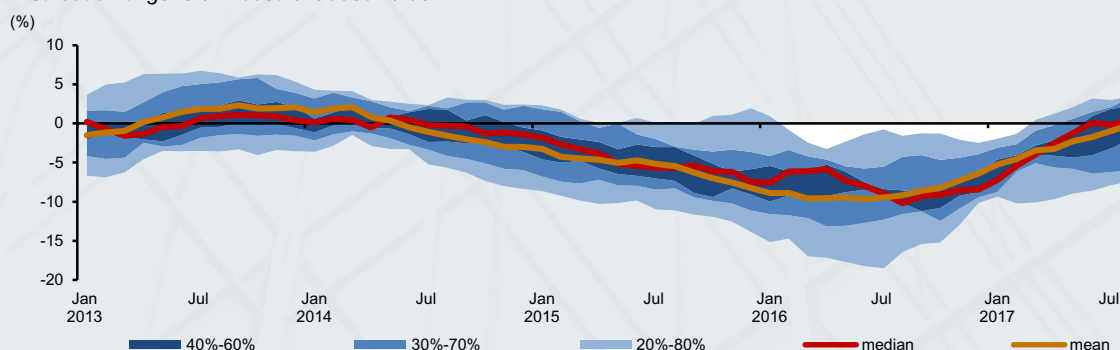


The recent industry recovery may be better understood by assessing its degree of dissemination and sectoral distribution. In this context, the dynamics of PIM disaggregated data were analyzed, comprising 83 sectors that represented 92.5 percent of the PIM in its base year<sup>4</sup>. Figures 4 and 5 show the evolution of the distribution of the changes in the

4/ For the analysis, data on activities, groups and industrial classes were combined, creating 83 non-overlapping sectors. In the selection of these sectors the analysis was limited to those with data available since 2002. The seasonal adjustment was made using the specification adopted by IBGE for the General Industry.

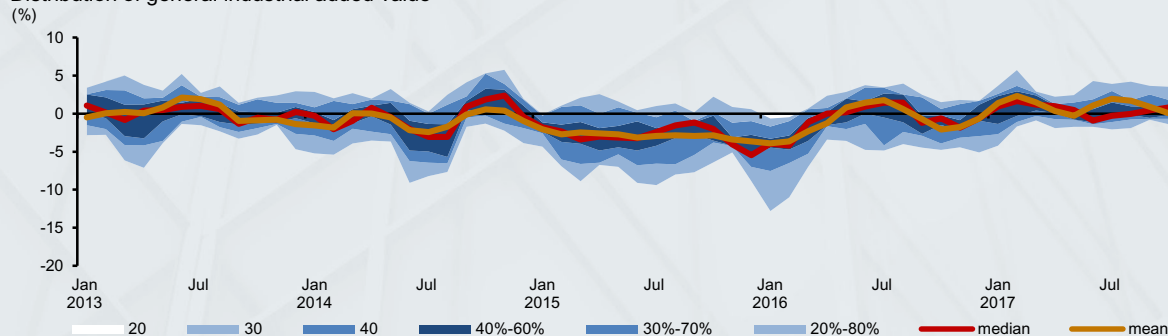
production of these sectors, accumulated in twelve and three months.

**Figure 4 – Dispersion of 12-month accumulated change – General industrial production**  
Distribution of general industrial added value



Source: IBGE

**Figure 5 – Dispersion of 3-month accumulated change – General industrial production<sup>1/</sup>**  
Distribution of general industrial added value



Source: IBGE

<sup>1/</sup> Changes in seasonally adjusted data.

It should be noted that, up to the end of 2016, there was a negative 12-month accumulated change in sectors that represented 80 percent of the Manufacturing Added Value (MVA), and the median of the change was only slightly positive since August 2017. Considering the 3-month accumulated change, the median becomes predominantly positive in 2017, highlighting the more widespread growth of the industrial sector.

In addition, it was considered whether the recent expansion of the industry was driven by cyclical sectors or whether it results only from growth in sectors whose dynamics are dissociated from the industry as a whole. For that purpose, a cycle measurement was calculated for each of the 83 sectors using a standard Hodrick-Prescott filter correlating this measure with the industry's cycle discounted from its own sector<sup>5/</sup>.

5/ The objective of this last step was to control for the size of each sector, preventing those with larger weights from having a larger correlation simply because of their weight. However, the results were very close to those where the sector was not discounted from the industry.

Considering the correlation coefficients in descending order, the sectors were segmented into three groups, so that the weight of each of the groups represented about one-third of the sample. The “high correlation” group included the sectors whose correlation with the total industry cycle was between 0.60 and 0.81, with emphasis on the manufacturing of automobiles, trucks and utilities, iron and steel, and parts and accessories for automotive vehicles. The “mean correlation” group included the sectors with a correlation between 0.25 and 0.60, with emphasis on the extractive industry, slaughter of pigs, poultry and other small animals, and other metal products. In the “low correlation” group (from -0.45 to 0.25), – the activities of manufacturing oil products, manufacturing and refining sugar, and manufacturing of pharmaceutical and pharminochemical products were the highlights.

**Figure 6 – General industrial production and groups according correlation with the Industry<sup>1/</sup>**  
2012 = 100



Source: IBGE  
1/ Seasonally adjusted data.

Figure 6 provide the series of the three groups, with seasonally adjusted data. As expected, the “high correlation” group presents the greatest variability. Of note, this group had the greatest contribution to the contraction of industrial activity both during the crisis of 2008-2009 and in the recent period (2014 to 2016). In the margin, the General Industry and the “average” and “high correlation” groups registered growth since the first half of 2016, the latter registering a larger contribution. Throughout 2017, the largest contribution was from the “low correlation” group, with growth of 6.8 percent in relation to December, although the most cyclical sector continued to show growth.

Broadly speaking, there are several indications that the recovery of the industry observed throughout 2017 is more correlated to the cycle of the economy, with sales geared to the domestic market and recovery of the cyclical sectors. Additionally, there is a consistent dissemination across sectors, with the spread of accumulated growth in three months more favorable than that of accumulated twelve-month growth. In this context, the analysis corroborates the perspective of cyclical recovery of the industry in 2018.