EUROPEAN CENTRAL BANK

EUROSYSTEM

Common factors of commodity prices

16 October 2018

By ⟩ Simona Delle Chiaie, ⟩ Laurent Ferrara and ⟩ Domenico Giannone[1]

There is a strong co-movement in the prices of international commodities. This is explained by a single common factor that is closely related to fluctuations in global economic activity. The common factor, which is indicative of global demand pressures, explains a large share of commodity price fluctuations, and its importance has increased since the early 2000s, especially for oil and metal prices.

While it is commonly argued that the prices of primary commodities tend to respond to many specific factors affecting supply and demand in individual markets, research studies as well as more informal narratives indicate that there is a strong co-movement between the prices of a broad range of seemingly unrelated commodities. Although this behaviour of commodity prices is not a recent phenomenon, their tendency to move in lockstep over the past decade has drawn renewed attention to the drivers of commodity price fluctuations. For central bankers, understanding the sources of commodity price changes is key to formulating an appropriate policy response since different shocks have distinct consequences on macroeconomic aggregates. This Research Bulletin, based on the work of Delle Chiaie, Ferrara and Giannone (2017), analyses the co-movement in commodity prices and illustrates how broad-based variations in commodity prices tend to be indicative of global demand pressures.

A model for the co-movement in commodity prices

The co-movement among the prices of a wide variety of commodities suggests that the bulk of their fluctuations are driven by a few common and pervasive factors, such as the global business cycle. Indeed, anecdotal evidence also indicates that episodes of persistent co-movement in commodity prices tend to be associated with changes in global economic activity (see for example Barsky and Kilian (2002)). Noticeably, there are also times when commodity prices move in different directions. That is because other specific factors related to supply and demand in individual markets can have a material impact on prices. However, unlike global forces, these factors, such as supply disruptions, might have a more limited propagation across markets.

To uncover the factors that affect commodity prices, Delle Chiaie, Ferrara and Giannone (2017) use a parsimonious[2] model for the co-movement of commodity prices and decompose each commodity price series into: (i) a component that is common to all commodities; (ii) components that are market-specific, i.e. that are common to all commodities that belong to the same market (such as metals, food or energy); and (iii) a component that is purely commodity-specific (or idiosyncratic). This distinction hinges on the idea that shocks of different nature have different consequences for the cross-correlation between commodity prices and provides a simple strategy for disentangling the underlying sources of fluctuations in commodity prices. The data included in the empirical analysis are monthly percentage changes of a large group of benchmark prices from both non-fuel and fuel commodity markets.

The global factor in commodity prices is closely related to changes in global economic activity

The results point to a substantial co-movement in commodity prices that is captured by a single factor, which we will call here the "global factor." The global factor is persistent and follows the major expansions and contractions in the international business cycle. The relation between the global factor and changes in

the international business cycle is also apparent when comparing the global factor with available indicators of world economic activity, suggesting a close link with the global demand for commodities (see Chart 1).

Chart 1. The global factor and measures of global economic activity
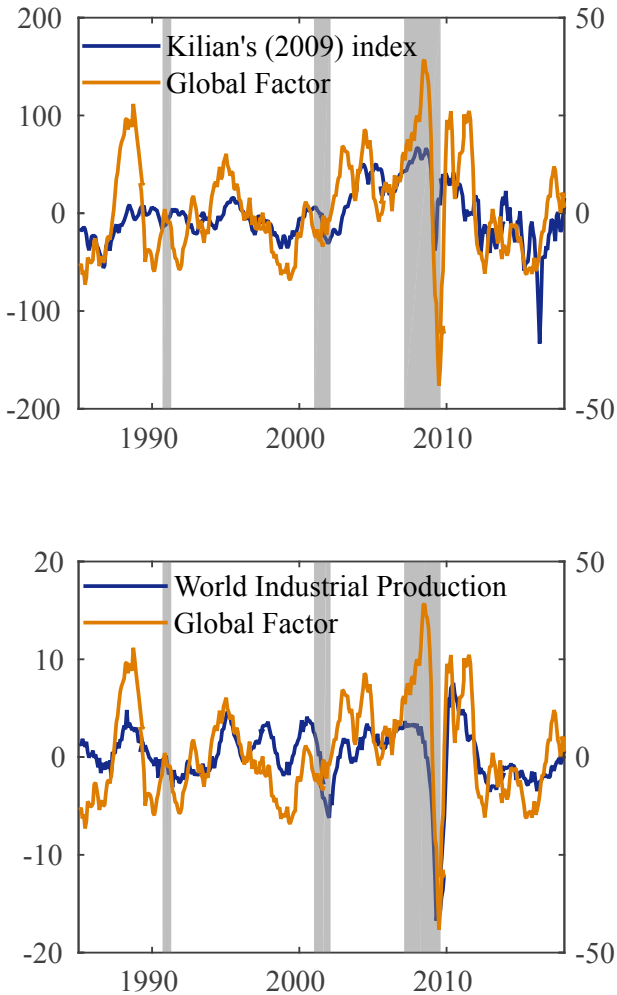
Note: The global factor and the world industrial production are year-on-year growth rates. The world industrial production is given by the monthly industrial production for the OECD countries plus 6 other majour countries (Brazil, China, India, Indonesia, the Russian Federation and South Arabia), as in Baumeister and Hamilton (2008). Kilian's index is a leading indicator for fluctuations in global economic activity. For details, see Kilian (2009). The light grey vertical shades mark NBER based recessions.

Interestingly, the global factor explains a significant share of movements in individual commodity prices but has limited effects on relative prices, since it tends to move prices in the same direction. This can be seen in the upper panel of Chart 2, which reports the changes in oil and copper prices and the fit based on their common components, i.e. the fit based on the global factor. Indeed, the latter tracks price fluctuations in both markets quite well and are almost indistinguishable. As a consequence, the fluctuations in the relative prices are not driven by the global factor, as shown in the lower panel of Chart 2.

**Chart 2. The global factor has limited effects on relative prices**
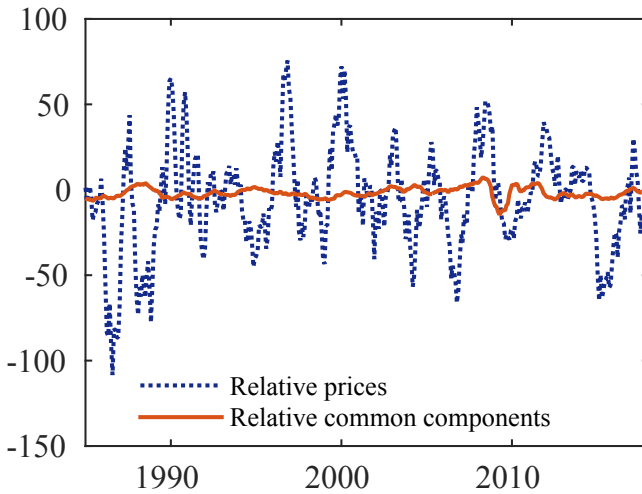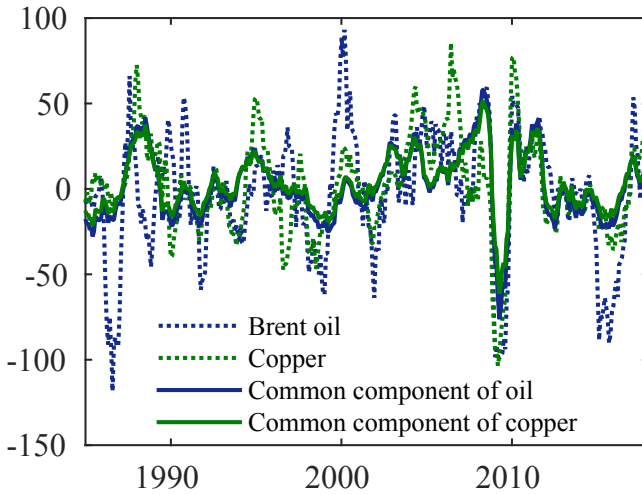
Note: All series are annual percent changes.

The importance of the global factor in explaining fluctuations in individual commodity prices explains why a number of studies have used changes in the price of copper or in a broad index of non-fuel commodity prices to isolate global demand components (see, for example, Hamilton (2014) and Bernanke (2016)). However, variations in such a limited group of commodities might be a poorer proxy of the global demand for commodities since their co-movement might capture industry and market-specific dynamics. The global factor extracted from a large set of fuel and non-fuel commodities reduces the impact of these confounding factors.

The importance of the global factor has increased since the early 2000s

Reflecting the rapid expansion in the demand for commodities from some emerging market economies, the importance of the global factor for commodity price fluctuations has increased since the early 2000s. The increase is remarkable for both oil and metal prices, indicating that global demand shifts have been, on average, a more important determinant for oil and metal prices than other shocks in the last two decades. This is clearly visible, for instance, when looking at the model-based historical decomposition of the price of Brent crude oil during the run-up in commodity prices from 2003 to mid-2008. As Chart 3 shows, the common component explains most of the oil price variations since 2003, which is consistent with the narrative of continued and surprising strength in the global demand for commodities over that decade. By contrast, some earlier historical episodes of important oil price fluctuations, such as the fall in the price of oil that followed the collapse of OPEC in 1986 and the spike that coincided with the Persian Gulf War in 1990-91, are not associated with similar variations in a broader group of commodity prices. The model attributes those movements mostly to factors specific to the fuel market (see fuel-specific components in Chart 3).

Chart 3. Model-based decomposition of the price of oil in key historical episodes
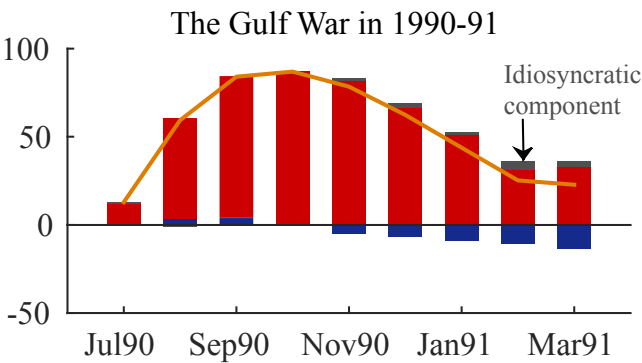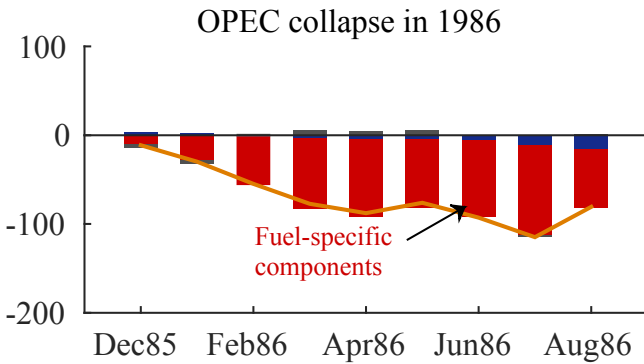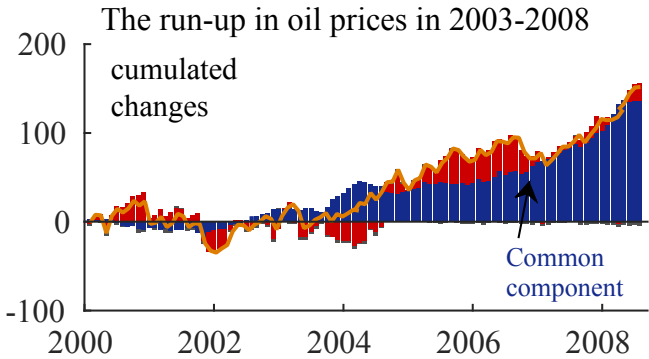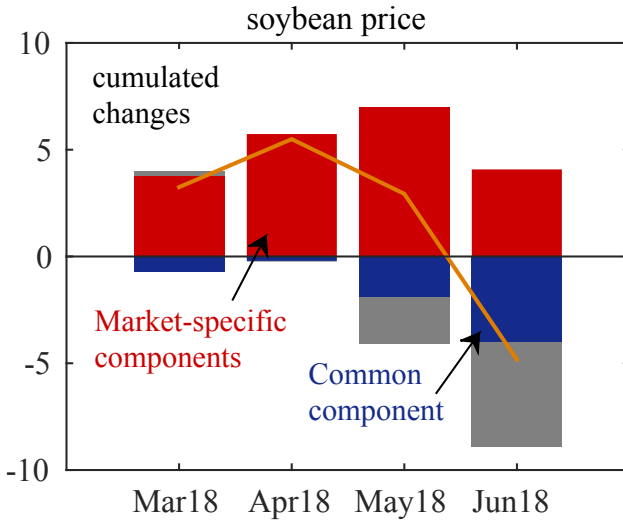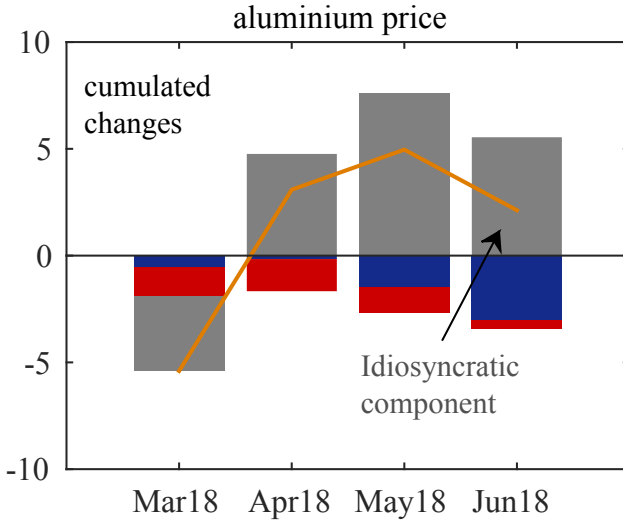

Note: The chart shows the historical decomposition of the price of oil, showing the cumulative effect at each point in time of global (blue), fuel-specific (red) and idiosyncratic components (grey) over three historical episodes of large oil price variations.

What has driven recent commodity price changes?

Large variations in some commodity prices have occurred in the past few months. For instance, the price of aluminium increased sharply last April, while in food markets the price of soybeans fell substantially[3]. Are these developments due to changes in global economic conditions or do they rather reflect other factors such as the imposition of sector-specific tariffs? Chart 4 decomposes the changes in aluminium and soybean prices that occurred from March to June 2018 through the lenses of our model. The results indicate that aluminium prices were pushed up by idiosyncratic factors, possibly reflecting supply-side disruptions caused by US sanctions against Russia. Import duties imposed by China in response to US tariffs on Chinese goods appear instead to have resulted in downward pressures on soybean prices, as these tariffs might have triggered expectations of a decline in China's demand for soybeans. The model reads these movements as idiosyncratic, as they are clearly confined to individual markets. However, trade tensions might have also curbed expectations about the future global demand for commodities in general, given that China is also the world's largest commodity importer. In the chart below, this is reflected by the increasing negative contribution of the common component, which has been evident both in aluminium and soybean prices since May.

Chart 4. Historical decomposition of aluminium and soybean prices

aluminium price

cumulated
changes

Idiosyncratic
component

Mar18　Apr18　May18　Jun18

soybean price

cumulated
changes

Market-specific
components

Common
component

Mar18　Apr18　May18　Jun18

Note: The chart shows the historical decomposition of aluminium and soybean prices, showing the
cumulative effect at each point in time of global (blue), market-specific (red) and idiosyncratic components
(grey) from March 2018 to June 2018.

Final remarks

Looking at the co-movement in a broad group of commodity prices is key to identifying the nature of commodity price fluctuations. In conclusion, this Research Bulletin article highlights a very simple strategy that central bankers can use to understand the drivers behind commodity price fluctuations. If commodity prices in all markets tend to move in the same direction and by a similar magnitude, then the global demand for commodities is largely responsible for those movements. If commodity price variations are instead localised to a few markets and/or there are important changes in relative prices, then other specific factors related to supply and demand in individual markets are likely to be at play.

References

Barsky R. and Kilian, L. (2002), "Do we really know that oil caused the Great Stagflation? A monetary alternative", *NBER Macroeconomics Annual* 2001, Vol. 16, pp. 137-183.

Baumeister, C., and Hamilton, J. D. (2018), "Structural Interpretation of Vector Autoregressions with Incomplete Identification: Revisiting the Role of Oil Supply and Demand Shocks," Working paper, University of California, San Diego.

Bernanke, B.S. (2016), "The relationship between stocks and oil prices".

Delle Chiaie S., Ferrara, L., and Giannone, D. (2017), "Common Factors of Commodity Prices", *ECB Working Paper Series,* No 2112.

Hamilton, J.D. (2014), "Oil Prices as an Indicator of Global Economic Conditions".

Kilian, L. (2009), "Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market", *American Economic Review*, Vol. 99, No 3, June 2009, pp. 1053-1069.

[1] Disclaimer: This article was written by Simona Delle Chiaie (Senior Economist, Directorate General International and European Relations, European Central Bank), Laurent Ferrara (Head of the International Macroeconomic Division, Banque de France) and Domenico Giannone (Assistant Vice President, Macroeconomic and Monetary Studies Function, Federal Reserve Bank of New York). It is based on a paper entitled "Common Factors of Commodity Prices" (2017) by S. Delle Chiaie, L. Ferrara and D. Giannone. The authors gratefully acknowledge the comments of Paul Dudenhefer, Michael Ehrmann, Geoff Kenny and Fabrizio Venditti. The views expressed here are those of the authors and do not necessarily represent the views of the Banque de France, the European Central Bank, the Eurosystem, the Federal Reverse Bank of New York or the Federal Reserve System.

[2] A model that uses as few parameters as possible to explain the data.

[3] The soybean price in the analysis is the price of US soybeans imported into Europe (Rotterdam CIF in USD).