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The fall in oil prices in 2014: the role of supply and demand components

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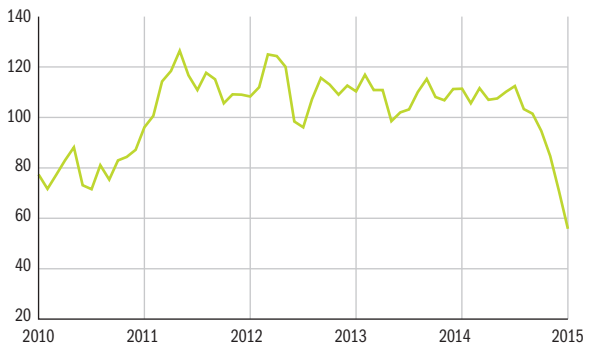
The price of oil plunged in the second half of 2014, falling by more than 40% from June to December 2014. In this article, we use a structural econometric model for the global oil market, as in Kilian and Murphy (2014), to quantify the contributions of oil supply, aggregate demand and oil-specific demand shocks to the cumulative oil price change from June to December 2014. The results obtained from the estimated model indicate that oil prices have been driven down by all three factors. However, unanticipated supply shifts explain only one-third of the oil price decline. Aggregate demand shocks associated with an unexpected weakening in global real activity and other oil-specific demand components related to changes in market expectations of future demand and supply conditions, account for a larger portion of the oil price fall.

This letter presents the findings of research carried out at the Banque de France. The views expressed in this post are those of the authors and do not necessarily reflect the position of the Banque de France. Any errors or omissions are the responsibility of the authors.

The price of oil plunged in the second half of 2014, falling from the peak of USD 115 per barrel on June 19 to USD 56.9 per barrel on December 30 (Chart 1). The causes behind this sustained decline in the price of oil – after a period of low volatility – have been the subject of intense debate. Understanding the factors behind the fluctuations in oil prices is indeed crucial to formulating the appropriate monetary policy response as the behavior of macroeconomic variables in response to oil price shocks depends on the underlying cause of the oil price variations (see, for example, Kilian, 2009).

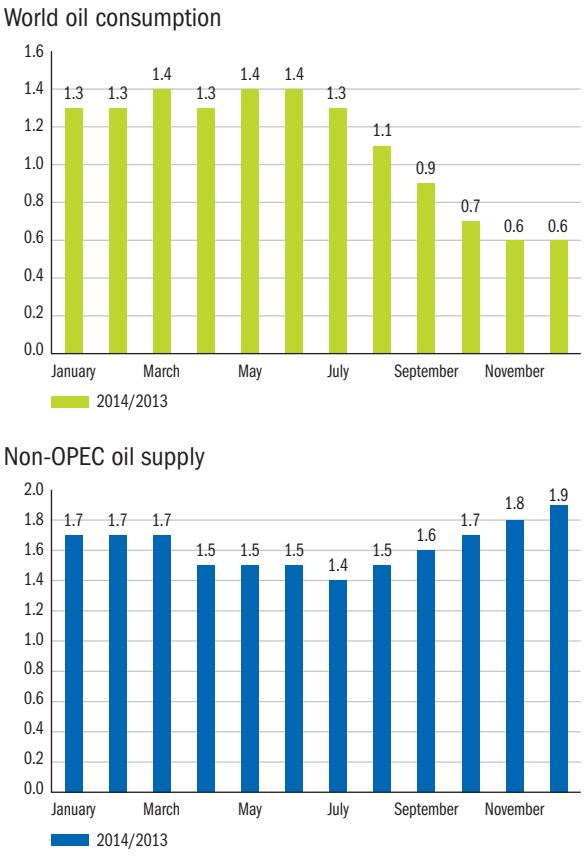
Within this debate, some commentators (for instance Arezki and Blanchard, 2014) have attributed most of the fall to a positive shift in oil production, while others have argued that the slowdown in global demand for oil associated with a weakening in real activity was an important factor behind this decline (see, for example, Baumeister and Kilian, 2015 and Delle Chiaie et al., 2015).

C1 Brent crude oil prices
(USD per barrel)



Source: Banque de France.
Note: Monthly averages.

C2 International Energy Agency (IEA) forecasts
(million barrels per day)



Source: Oil Market Report *(IEA).*
Note: The figures report changes compared to the previous year expressed in millions of barrels per day.

Oil supply and demand conditions

There are various reasons to believe that both supply and demand conditions have contributed to the fall in the price of oil. First, global demand for crude oil seems to have weakened in the second half of 2014. To illustrate this point, Chart 2 (top panel) reports the estimates for world oil consumption for the year 2014 published by the International Energy Agency (IEA) in its monthly *Oil Market Report* throughout 2014. As Chart 2 shows, while oil consumption for 2014 was expected to increase by 1.4 million barrels per day in June, this estimate was progressively revised downwards to 0.6 million barrels per day by the end of the year. These important historical revisions to world oil demand were primarily the result of a sharp slowdown in demand for oil in China and steep contractions in Europe and Japan.

On the supply side, oil production in non-OPEC regions and, in particular, in the United States, surprised on the upside and forecasts for 2014 were revised upwards during the second half of the year (Chart 2, bottom panel). Thanks to the production of oil from shale formations, the United States has become the leading contributor to oil supply growth and this has had important consequences for OPEC countries. Increasing supply together with lower demand has in fact reduced the "call on OPEC" (i.e. the amount of oil that OPEC has to supply to balance the market) as well as the share of OPEC's supply in world oil production. In response to these developments, OPEC decided in late November not to curb its production target, leaving the market oversupplied.

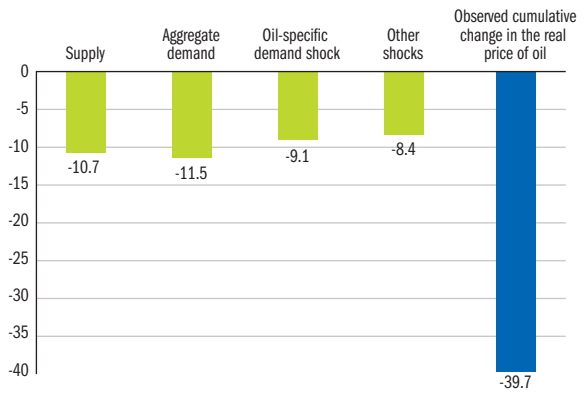
A model of the world oil market

While all these developments seem to suggest that the oil price fall was driven by various shocks that took place in the course of 2014, the identification of the different sources of fluctuations in the price of oil requires a structural model for the oil market. In this article, we use a structural VAR (Vector Auto Regressive) model, as in Kilian and Murphy (2012, 2014), to investigate the contributions of various factors to the cumulative oil price change from June to December 2014. An important novelty of these models is that they consider that oil prices do not respond only to variations in oil production and global real activity, but rather that there are important forward-looking elements in the spot price of oil that cannot be captured by past data. In fact, as oil is a storable commodity, the demand for oil inventories can change in response to news, typically geopolitical issues that generate uncertainties about future supply, new oil discoveries, or revisions to the expected future demand for oil. All these events are likely to affect market expectations regarding future demand and supply conditions, resulting in an immediate change in the demand for oil inventories. This will cause a shift in the oil demand schedule and, in turn, a change in the oil price. As discussed in Kilian and Murphy (2014), while traditional models of supply and demand cannot capture these expectation shifts, they can be identified using a structural econometric model which includes inventory data.

What explains the oil price fall in 2014?

We start our analysis by estimating the Kilian and Murphy (2014) model over the period from February 1973 to December 2014. The set of endogenous variables used in the VAR consists of monthly data for the percentage change in global crude oil production, a measure of global real economic activity (in deviation from trend), the real price of oil and, finally, the change in global crude oil inventories. For the latter variable,

C3 Historical decomposition of the real price of oil from June to December 2014
(USD per barrel)



Source: Author's estimates.

we use the OECD commercial inventories as a proxy for global petroleum stocks. The model distinguishes between four structural innovations to the price of oil which are identified using sign restrictions derived from economic theory and bounds on the implied price elasticities of oil demand and oil supply.[1] The first innovation consists of a shock to the oil supply which reflects, for instance, supply disruptions associated with exogenous events in oil-producing regions or, for instance, unexpected decisions from OPEC. A second shock captures shifts in the demand for oil and other industrial commodities associated with unexpected fluctuations in the world business cycle. To capture shifts in market expectations of future demand and supply conditions, the model also includes an oil-specific demand shock which involves changes in oil inventories. A positive oil-specific demand shock will cause, in equilibrium, an accumulation of oil inventories and will raise the real price of oil. Finally, a residual shock reflects other idiosyncratic changes in demand not captured elsewhere.

Based on the estimated VAR parameters and the shocks identified with sign restrictions, we then derive the historical decomposition of the real price of oil for the period from June to December 2014. The results are reported in Chart 3 which shows the cumulative effect of each structural shock on the real price of oil from June to December 2014. Chart 3 confirms that all three shocks contributed to the fall in the real price of oil and they are able to explain about 80 per cent of the decline.

1 *For details on the identification strategy, we refer the interested reader to Kilian and Murphy (2014).*

Unanticipated supply shifts account for about 27 per cent of the oil price drop, while aggregate demand shocks associated with an unexpected weakening of global real activity explain about 28 per cent of the fall. Interestingly, oil-specific demand shocks, related to changes in market expectations, also played a non-negligible role in determining the oil price decline (23 per cent). This latter shock is consistent with market expectations of ample future supplies triggered by the OPEC announcement, or expectations of further slowdowns in global oil demand, or plausibly a combination of both.

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