

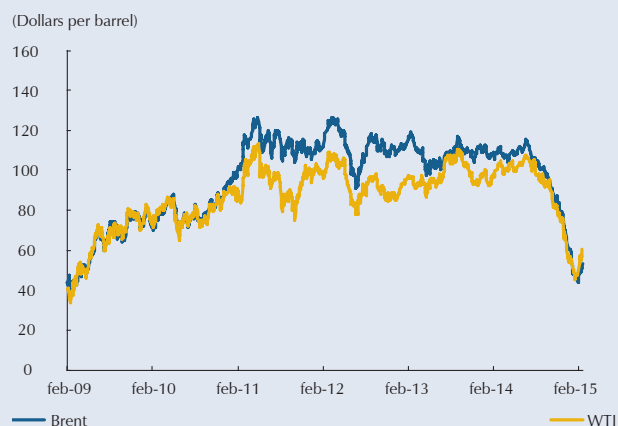
## Box 1 DETERMINANTS OF THE RECENT DECLINE IN OIL PRICES, FORECAST EVALUATION AND OUTLOOK\*

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The price of Brent crude oil remained relatively stable between early 2011 and the first half of 2014, averaging USD 110 per barrel (bl). However, after late June 2014, when it reached a record high for the year (USD 115.5 / bl), the price plunged 60% to USD 45.8 / bl in January 2015, followed by a partial recovery in mid-February (USD 61 / bbl) (Graph B1.1). This unexpected reduction was considerable in scope and originates from a combination of factors, including demand and supply shocks, and possible financial markets' reactions.

Cutbacks in worldwide oil demand forecasts<sup>1</sup> began to be observed during the second half of 2014, in response to weaker global growth prospects (IEA, 2014b). Added

Graph B1.1  
International Oil Prices (Brent and WTI)



Source: Datastream.

\* This section was developed with figures up to early February 2015, which are more recent than those used in the rest of this report.

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1 (Note 1 Box 1) The forecast for the demand for crude oil worldwide in 2015 as a whole was cut from around 94.1 million barrels per day (mbd) to 93.3 mbd between mid-2014 and early 2015 (IEA, 2014A and 2015).

to this was the build-up in alternate energy sources implementations and more efficient fuel use observed during the past decade (Kemp, 2015).

According to the World Bank (2015), a stronger dollar is another factor that can adversely affect oil prices, since crude oil demand expectations can decline due to loss of purchasing power of oil-purchasing countries' currencies. In fact, the dollar appreciated 9.7% between the start of the drop in oil prices and their lowest level in January 2015.

As Kilian points out (2014), fluctuations in the real price of oil since 1973, and including the sustained growth episode between 2003 and 2008, were primarily the result of demand shocks. During the latest episode, Hamilton (2014) attributed approximately 47% of the price decline to this type of factors, while Arezki and Blanchard (2014) suggest that 20% to 35% of the drop could be explained by the unexpected reduction in demand.

Additionally, global supplies of oil rose at an annual rate of 2.1%<sup>2</sup> in 2014, surpassing the increase in demand (0.7%), and it is expected to remain abundant in 2015. This, coupled with the prospect of a low global demand, has lowered agents' price level expectations.

The greater global supply was mainly the result of an increased production in the United States since 2011<sup>3</sup> due to the growth in unconventional crude extraction. This phenomenon was driven by high oil prices seen in previous years, which made possible to cover the high costs associated with technologies such as hydraulic fracturing and horizontal drilling, used to extract these resources (Kemp, 2015).

The large 2014 supply also benefited from stable production in Russia and in the member states of the Or-

2 (Note 2 Box 1) Global supply increased from 91.4 mbd in 2013 to 93.3 mbd in 2014. At the same time, demand went from 92.4 mbd to 91.8 mbd (IEA, 2015).

3 (Note 3 Box 1) While the global supply of oil rose from 88.6 mbd in 2011 to 93.3 mbd in 2014 (an increase of 4.7 mbd), the supply in the United States was up by 3.1 mbd, having gone from 5.6 mbd to 8.7 mbd during the same period (IEA, 2015, ISA, 2015).

ganization of Petroleum Exporting Countries (OPEC), despite the presence of internal conflicts in some of them.<sup>4</sup> In fact, Libya registered a partial recovery in production, while production in Iraq reached historically high levels in late 2014, all of which contributed to the growth in global supply (OPEC, 2015). This was contrary to forecasts of possible supply problems, which led to a correction in price expectations when they did not materialize (World Bank, 2015).

Moreover, at its meeting in late November last year, OPEC decided to maintain production levels despite the drop in prices observed up to that point. This changed expectations about future oil supply and contributed to the price decline (Arezki and Blanchard, 2014). Some analysts say the leading OPEC members adopted a strategy to maintain market share by not cutting production back and even lowering prices (IEA, 2015). This tactic also intended to affect the growing supply of unconventional crude, which is costly to extract and could cease to be profitable as sale value declines (Arezki and Blanchard, 2015). As a result, companies that extract unconventional oil would face cash flow constraints and borrowing restrictions in order to maintain investment levels (*The Economist*, 2014).

Finally, hedge funds and other market agents drastically reduced their net long positions in crude oil futures and options, possibly provoking further downward pressure on oil prices. In this regard, Kolodziej and Kaufmann (2013) find evidence that would support the assumption of a two-way adjustment link between agents' positions and oil prices.

### Forecast Analysis

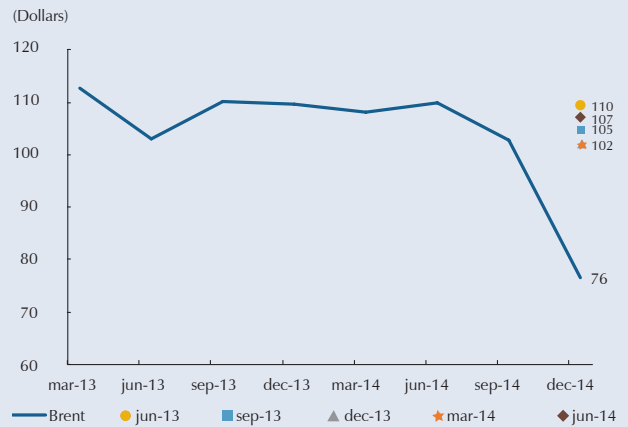
The recent price decline was both considerable and unexpected. In fact, analysts' forecasts and those implied by futures contracts were way off mark compared to the end of 2014 actual situation.

As of June 2013, analysts and futures contracts anticipated prices above USD 100 / bbl by the end of 2014<sup>5</sup>

4 (Note 4 Box 1) The OPEC supply in 2014 remained above 30 mbd, similar to what it was the year before. Russia, another major oil producer, also maintained hefty levels above 10 mbd (OPEC, 2015).

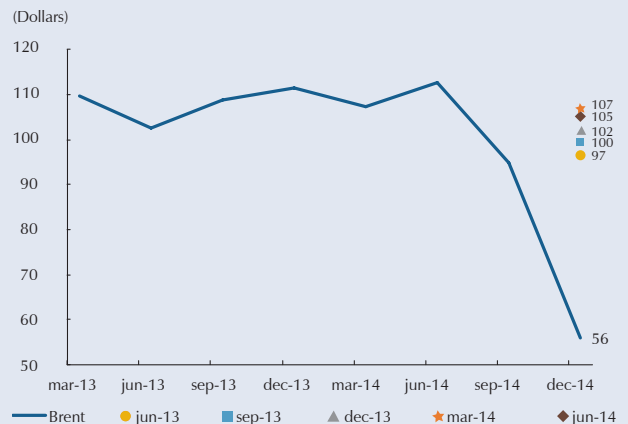
5 (Note 5 Box 1) The analysts' forecasts refer to the quarterly average; the futures contracts refer to the quarter average in the Bloomberg survey.

Graph B1.2  
Observed Brent Crude Price and Forecasts in the Last Six Quarters for the Average Price in the Fourth Quarter of 2014 (Quarterly average)



Source: Bloomberg.

Graph B1.3  
Observed Brent Crude Price and Futures Contracts in the Last Six Quarters for December 2014 (On the last day of the quarter)



Source: Bloomberg.

(Graphs B1.2 and B1.3). This expectation was maintained even into the second quarter of 2014.

A statistical analysis of the forecast errors<sup>6</sup> points to the existence of an upward bias, plus an increase in error as

6 (Note 6 Box 1) The accuracy of forecasts made by market analysts (quarterly averages) and those implied by futures contracts (end-of-quarter) is evaluated. This assessment relied on quarterly data from the five periods prior to the change in trend and up to the forecast horizon listed the tables. The periods of price decline in the final quarter of 2008 and 2014, and the partial recovery at the end of 2009 were employed as points of reference. Four standard measures were used; namely, i) the mean

soon as the forecasts for the end of 2014 were taken into account, at which point the change in the trend in crude prices became more pronounced (Tables B1.1 and B1.2).

**Table R1.1**  
Forecast Error Analysis: Market Analysts' Forecasts (2013-2014)

Date	Steps Forward	MFE	MAD (USD)	MAPD (%)	MASE
Mar-13	5	-	3.04	2.85	3.22
Jun-13	5	-	2.60	2.47	4.67
Sept-13	5	-	8.13	9.73	4.42
Dec-13	5	-	7.74	9.09	4.21
Mar-14	4	-	8.77	10.57	2.98
Jun-14	2	-	18.95	23.56	1.45

Source: Authors' calculations.

**Table R1.2**  
Forecast Error Analysis : Futures Contracts (2013-2014)

Date	Steps Forward	MFE	MAD (USD)	MAPD (%)	MASE
Mar-13	5	+	4.04	3.73	4.07
Jun-13	5	+	5.57	5.11	6.07
Sept-13	5	+	8.50	7.78	5.64
Dec-13	5	-	12.70	19.95	3.82
Mar-14	4	-	17.63	27.73	3.39
Jun-14	2	-	30.91	50.86	1.59

Source: Authors' calculations.

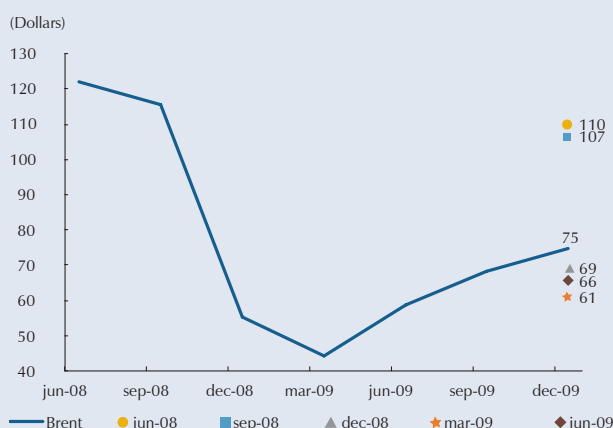
forecast error (MFE), which indicates if the forecast errors, on average, were above or below observed values (a positive sign shows a downward bias in the forecast and a negative sign, an upward bias); ii) the mean absolute deviation (MAD), which is the mean deviation of the forecast in dollars (absolute value); iii) the mean absolute percentage deviation (MAPD), which is the mean percentage deviation of the error and, finally, iv) the mean absolute scaled error (MASE). This last measure is the ratio of the sum of the forecast errors to the average of the errors shown by the naïve forecast, which is equal to the value actually observed in the immediately preceding third quarter. If it is less than 1, the forecast in question is better than the naïve forecast; if it is above 1, it is worse.

The plunge in oil prices at the end of 2008 was analyzed as well. For that period, analysts forecast that the price would not remain above USD 100 / bbl as of the end of 2008 and would return to the levels observed in the second half of 2007; namely, between US \$ 75 / bbl and USD 90 / bl. However, the price dropped far more than expected.<sup>7</sup> The forecast errors showed larger deviations than those pertaining to the event in 2014, since the drop in 2008 was preceded by sharp hikes in the price of crude.<sup>8</sup>

What agents expected one year forward, after the drop in oil prices during late 2008, was examined as well. On that occasion, the forecasts in December 2008 and in March and June 2009 captured the subsequent recovery in prices, but underestimated its magnitude. While the average price in the final quarter of 2009 was USD 75/bbl, analysts expected between USD / bl 61 and \$ 69 / bbl (Graph B1.4). This underestimation was even larger in the futures contracts (Graph B1.5).<sup>9</sup>

The forecast error analyses show that projections made by analysts and those implied in futures contracts are

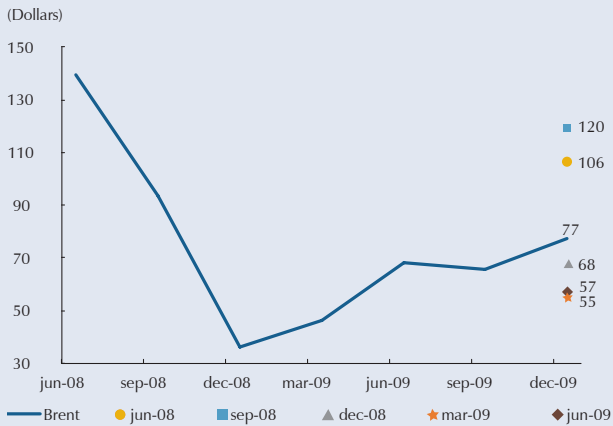
**Graph B1.4**  
Observed Brent Crude Price and Forecasts in the Last Five Quarters for the Average Price in the Fourth Quarter of 2009 (Quarterly average)



Source: Bloomberg.

- (Note 7 Box 1) The gap in the future contracts was even greater, since the price at the end of the year was US 36/bl as opposed to USD 131/ bl anticipated six months earlier.
- (Note 8, Box 1) Neither analysts nor futures contracts anticipated the sharp rise observed between March 2007 and June 2008 or the subsequent drop at the end of last year.
- (Note 9 Box 1) The assessment shows a significant forecast error, which is corrected later to some degree, once agents included the actual decline.

Graph B1.5  
Observed Brent Crude Price and Futures Contracts in the  
Last Five Quarters for December 2009  
(On the last day of the quarter)



Source: Bloomberg.

less accurate than a naive forecast. The difficulty in anticipating major changes in oil prices highlights the importance of macro-prudential policies in oil-exporting countries, since they need to cushion the impact of unexpected variations can have on their economies (Mas-son, 2014).

### The Outlook for 2015

As discussed in previous sections, trend changes in oil prices are unexpected, can be significant, and are influenced by a number of time varying factors (Killian, 2010). Furthermore, when the recent high volatility is accounted for, it is difficult to determine how this variable will behave.

A great deal of the dynamics in international oil prices during 2015 depend on the persistence of shocks that provoked its decline in recent months. Accordingly, there are be factors that could drive a partial recovery in price with respect to the lows reached in mid-January of this year (USD 45.8 / bbl), but at levels below the average observed between 2011 and the first half of 2014 (USD / 110 bl).

A partial improvement in prices would be consistent with what leading market analysts expect.<sup>10</sup> However, it as-

10 (Note 10 Box 1) The Bloomberg analysts, on average, expect the mean price in 2015 to be USD 62.2 / bl, while the United States Energy Information Administration (EIA) forecasts an average of USD 57.6/ bl.

sumes that much of the downward shock to prices would persist throughout the current year.

In this partial recovery scenario, global demand is expected to recover somewhat in 2015, largely due to the positive impact that lower fuel costs will have on the disposable household income and on the production costs of oil-importing countries. The effect on growth for these economies could be greater than the slowdown observed in oil-producing countries, originated in a lower oil-sector investment, a decline in terms of trade, and added pressure on fiscal accounts.

Accordingly Arezki and Blanchard (2015), the Institute of International Finance (IIF, 2014) and the World Bank (2015) estimate that the collapse of international prices for crude oil would add between 0.2 and 0.9 percentage points (pp) to worldwide GDP growth. The International Energy Agency (IEA, 2015) estimates the average demand for oil in this environment would increase from 92.4 million bpd in 2014 and 93.3 mbd in 2015.

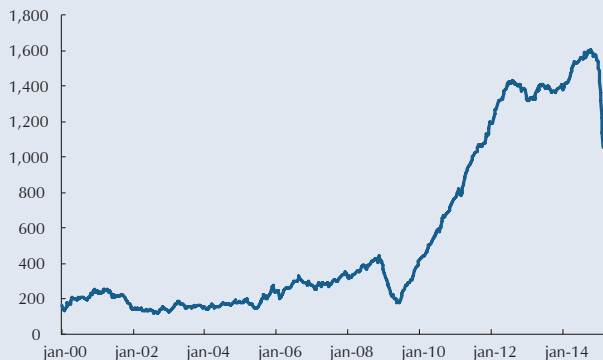
On the supply side, the extraction of unconventional oil, mostly located in North America, would decline in this scenario, since in some cases their marginal costs would be above current prices. According to the consulting firm Rystad Energy (2014), the marginal costs for shale oil are between USD 40 / bbl and US65 / bbl, while those for oil sands are on the USD 50-85/bbl range.

The cutback in unconventional oil exploration would come in the second half of the year, since the initial investment in many of these wells has been made already. Consequently, extraction would continue in an effort to recover some of the sunken costs and to meet acquired financial obligations.<sup>11</sup> Additionally, production levels on these wells declines relatively quickly. So, if low oil prices prevent new investments, the extraction of these resources may decline. The recent decline in the number of rigs for crude oil exploration and extraction in the United States (Graph B1.6) may be signaling the onset of that scenario.

Accordingly, there are announcements by the major oil companies of a lower investment worldwide, which suggest a decline in oil production in the medium term.

11 (Note 11 Box 1) The production of unconventional oil likely has more price elasticity than estimated initially. If so, the rise in production would begin to slow during the early months and would be faster than anticipated, thereby contributing to a quicker increase in price.

Graph B1.6  
Number of Drilling Rigs Used for Oil Exploration and  
Extraction in the United States



Source: Baker Hughes Incorporated.

This might affect agents' expectations about future supply and pressure upwards oil prices.

As for geopolitical risks, interruptions in oil supply as a result of conflicts in the Middle East or North Africa cannot be ruled out and could spark a larger recovery in price.

However, there are factors that could prevent such a recovery or cause additional reductions in price. On the demand side, for example, if any of the downside risks to global growth (Chapter 1) were to materialize (especially those related to the euro area and China) the demand for crude oil would weaken and an increase in its international price would be delayed.

As for supply, OPEC will not cut its production during 2015, aiming to maintain its market share.<sup>12</sup> Another factor is the accumulation of oil inventories, which will keep the supply high during the coming months. In geopolitical terms, an agreement with Iran over its nuclear program might be achieved. If this is the case, it could allow the removal of sanctions imposed by the United States and the euro area, thereby giving Iranian oil access to international markets.

Ultimately, technological advances and efforts to improve efficiency might have lowered the marginal costs of unconventional reserves below those estimated initially. If so, supply at current prices could remain large. If true, this

12 (Note 12 Box 1) By having lower costs, OPEC is in a better position than unconventional crude oil producers to withstand lower prices. However, it is important to remember the economies of OPEC member countries are highly dependent on oil exports and may not be able to tolerate low prices for a prolonged period of time.

would imply a structural change in the world oil market and a factor that could trigger a persistent decline in prices.

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