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**by**

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## Abstract

In the second half of 2014, oil prices experienced a sharp decline, falling more than 50 per cent between June 2014 and January 2015. A cursory glance at this oil price crash suggests similarities to developments in 1986, when the price of oil declined by more than 50 per cent, initiating an episode of relatively low oil prices that lasted for more than a decade. This analytical note compares the 1986 price decline with the current episode more closely, and its key findings suggest important differences. While oil demand had been falling in the beginning of the 1980s, demand growth currently is being sustained by emerging economies and is projected to be more stable. Also, spare production capacity is significantly smaller today. Due to higher decline rates and shorter investment cycles of unconventional production, current supply is expected to adjust faster to low prices and reductions in investment spending. As long as oil demand from emerging economies remains robust, increases in production will require additional investment in high-cost production. The cost of this incremental production points to higher prices in the medium term than were observed in 2015, although the potential size of a price increase is limited because of ongoing cost-cutting initiatives and technological advances. Due to the fundamental changes in the oil market, it is unlikely that a decade of low oil prices—similar to the experience following the 1986 oil price crash—will repeat itself.

*Bank topics: International topics; Recent economic and financial developments*

*JEL codes: E3, Q4, Q41, Q43*

## Résumé

Au second semestre de 2014, les cours pétroliers ont connu une baisse marquée, soit une chute de plus de 50 % entre juin 2014 et janvier 2015. À première vue, cet effondrement des prix du pétrole présente des similitudes avec la situation de 1986. À l'époque, le prix du baril avait également perdu plus de 50 %, ce qui a marqué le début d'une période de plus de dix ans où les cours pétroliers ont été relativement bas. Dans la présente note, nous comparons de plus près le fléchissement des prix de 1986 avec le contexte actuel. Nos principales conclusions démontrent d'importantes différences entre les deux périodes. Si la demande de pétrole a chuté au début des années 1980, sa croissance actuelle s'annonce plus stable, soutenue par les économies émergentes. De plus, la marge de capacités excédentaires est beaucoup plus faible en ce moment. Comme la production non traditionnelle présente des taux de diminution des réserves plus élevés et se caractérise par des cycles d'investissement plus courts, l'offre devrait s'adapter plus rapidement aux faibles prix et aux réductions des dépenses d'investissement. Tant que la demande de pétrole provenant des économies émergentes demeure vigoureuse, les hausses de production entraîneront nécessairement d'autres investissements dans la production à coût élevé. Le coût de cette production supplémentaire laisse présager des prix à moyen terme supérieurs à ceux observés en 2015, mais l'ampleur éventuelle

d'une hausse des prix reste limitée en raison des avancées technologiques et des projets en cours visant à réduire les coûts. Compte tenu des changements fondamentaux survenant dans le marché du pétrole, il est peu probable que nous assistions de nouveau à une période où les cours pétroliers demeureraient faibles pendant une dizaine d'années – comme cela a été le cas après la chute des prix du pétrole de 1986.

*Sujets de la Banque : Questions internationales; Évolution économique et financière récente*  
*Codes JEL : E3, Q4, Q41, Q43*

## Summary

In 1986, oil prices declined by more than 50 per cent, initiating an episode of relatively low oil prices that averaged roughly \$30 a barrel over the next decade in real terms (2014 prices). In the second half of 2014, oil prices experienced a similar decline, falling more than 50 per cent between June 2014 and January 2015. Many analysts argue that another decade of low prices lies ahead, coining the term “low for longer.” This analytical note compares the 1986 price decline with the current episode more closely, and its key findings suggest important differences that make a repeat of the 1986 episode unlikely for the following reasons.

- **Demand growth has remained positive over recent years.** In the five years prior to 1986, oil demand growth had been declining outright, driven by falling Organisation for Economic Co-operation and Development (OECD) consumption after oil price spikes in the 1970s. In contrast, demand growth prior to the current episode stayed positive and is expected to remain so, underpinned by growth in emerging markets.
- **The Organization of the Petroleum Exporting Countries (OPEC) has less spare capacity today.** In an unsuccessful attempt to hold prices high in the early 1980s, OPEC reduced output until its spare capacity by 1985 reached 17 per cent of global production—a historical record.<sup>1</sup> This meant that an abundance of cheap oil was readily available to be brought on the market. Today, OPEC’s spare capacity is estimated to be only 2 to 3 per cent of global production.<sup>2</sup> Outside of US shale, additional supply today, whether OPEC or non-OPEC, can only be brought on stream slowly over time after substantial new investment.
- **Oil production has become more sensitive to price changes.** Before the 1986 oil price crash, conventional oil production in OECD countries was increasing quickly. The long investment cycles of these projects meant that new production was still being brought on stream even after prices fell. Today, a significant share of non-OPEC production comes from shale oil, which exhibits shorter investment cycles and higher decline rates.
- **Over the next few years, prices will likely rise to stimulate the investment needed to meet increasing demand.** Output is expected to stall or decline without sufficient investment, which fell by more than 25 per cent globally in 2015.<sup>3</sup> To meet rising demand, oil prices will likely increase to the full cycle cost of unconventional sources such as US shale. The potential amount of a price increase is limited, however, because ongoing cost-cutting initiatives and technological advances are helping to lower production costs, particularly for unconventional oil production such as shale oil.

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<sup>1</sup> The U.S. Energy Information Administration (EIA) defines spare capacity as production that can be brought online within 30 days and sustained for at least 90 days.

<sup>2</sup> The International Energy Agency (IEA) estimated OPEC spare capacity at roughly 2.85 million barrels per day (mb/d) in April 2016. Using a more conservative definition of spare capacity, the 10 May 2016 EIA *Short-Term Energy Outlook* estimates OPEC spare capacity to be roughly 1.5 mb/d in 2016 (EIA 2016a).

<sup>3</sup> This includes investment from conventional and unconventional sources. Numbers are based on Bank of Canada calculations.

## Background: Reasons for the 2014 Oil Price Crash

### The decline in 2014

From 2011 through the middle of 2014, global oil prices fluctuated within a narrow range around \$110 per barrel, as unplanned supply outages from Libya and Iraq, among other places, were offset by persistent supply increases related to the boom in unconventional oil production from US shale and Canadian oil sands. In the second half of 2014, unplanned outages lessened while unconventional oil production continued to rise towards new highs, creating a supply glut that surprised forecasters and placed downward pressure on oil prices.<sup>4</sup>

Weak demand has also been a factor. Throughout 2014, global growth prospects in general and oil demand growth slowed, particularly in Europe, Japan and China.<sup>5</sup> Annual oil demand growth fell by about one-third compared with the 2010–13 period.<sup>6</sup> While we estimate that supply-side developments accounted for about three-quarters of the price decline in the second half of 2014, these demand-side developments cannot be ignored.<sup>7</sup>

The combination of surprisingly high shale output, lower OPEC supply outages and unexpectedly weak demand caused the price of Brent oil to fall from an average of \$112 in June 2014 to around \$80 by mid-November 2014. The resulting excess supply condition was further exacerbated by OPEC's decision at the end of November 2014 to maintain its output quota. In effect, the cartel abandoned any pretense of acting as the oil market's swing producer, one that balances supply with demand.<sup>8</sup> The announcement that OPEC would not cut production led instantly to a \$6 decline in the oil price, which continued to fall through December and then bottomed out at \$46 in January 2015.<sup>9</sup>

### Developments through 2015

Oil prices rebounded to more than \$60 in the first half of 2015. Unconventional oil production, particularly US shale, continued to increase despite a sharp fall in the drilling rig count. Shale's resilience was aided by productivity gains and the contango in the oil futures market, which allowed producers to hedge future production at prices well above the spot prices. When, amid increasing production, concerns about the

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<sup>4</sup> In 2011, the U.S. EIA had forecast US crude oil production would increase from 5.5 mb/d in 2010 to 5.8 mb/d in 2014, whereas actual production reached 8.6 mb/d.

<sup>5</sup> International Monetary Fund's (IMF) 2015 growth forecast was revised downward from 3.8 per cent to 3.7 per cent between April and October 2014 and then to 3.5 per cent by January 2015 (IMF 2015). The IMF forecasts are also an important input for EIA's oil demand forecasts.

<sup>6</sup> Sources: EIA (2016b) and BP (2015).

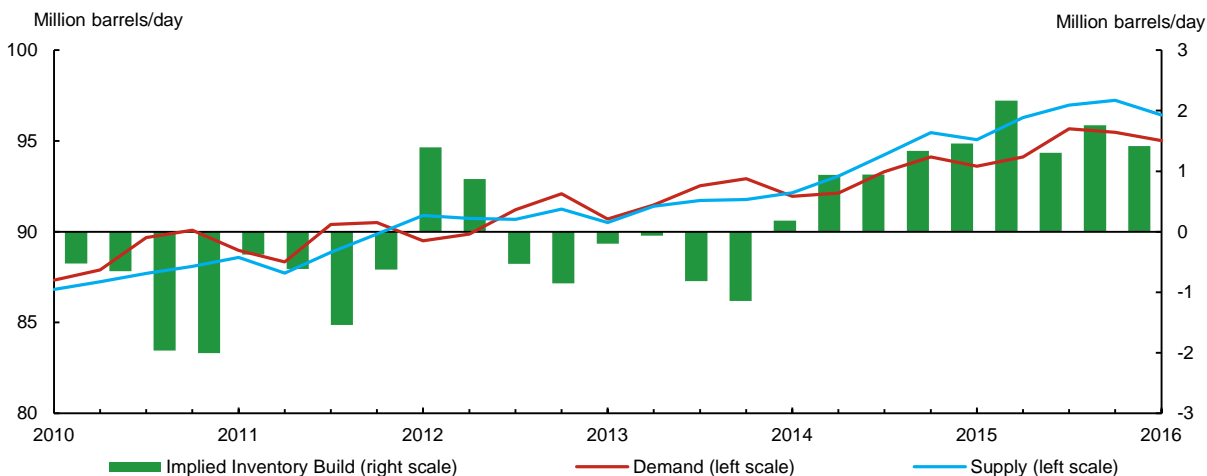
<sup>7</sup> Our estimation is based in part on a structural vector-autoregression (VAR) model, which includes the percentage change in global crude oil production, an indicator for global economic activity, the real price of crude oil and the change in above-ground oil inventories. For more detail on the model, please see Kilian and Murphy (2014).

<sup>8</sup> When the global oil market was out of balance, OPEC generally adjusted its production to bring supply and demand closer together. In contrast, OPEC ministers decided at their Vienna meeting in November 2014 to leave the output ceiling unchanged despite the existing excess supply. This decision was pushed through by the cartel's core members, particularly Saudi Arabia. Due to Saudi Arabia's market power, other OPEC members such as Venezuela that initially opposed the decision had no choice but to follow it.

<sup>9</sup> The reasons for OPEC's change in stance are unclear. Its strategic long-term goals are likely an increase in market share vis-à-vis high-cost producers, maintaining demand for fossil fuels and/or geopolitical considerations.

slowdown of the Chinese economy emerged during the summer, prices dropped again, this time to less than \$50.<sup>10</sup> Global crude inventories have built up rapidly over 2015 (**Figure 1**). Since the second half of 2015, storage has been well above its five-year average and there are few signs that inventories will be drawn down soon.

**Figure 1: Oil inventories built rapidly over 2015**



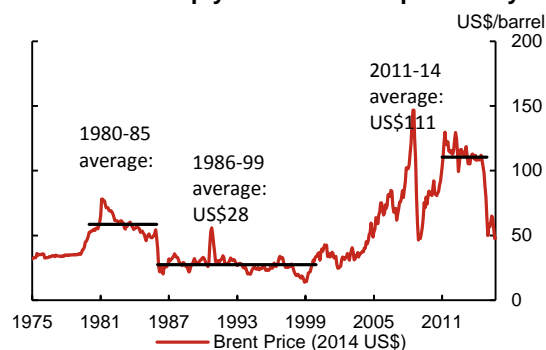
Source: International Energy Agency

Last observation: 2016Q1

## How Does the 2014 Price Decline Compare with the 1986 Crash?

A cursory glance at the current oil price crash suggests similarities to developments in 1986, when the price of oil declined more than 50 per cent between January and July to a low of \$21 (in 2014 real terms). In both cases, the oil price lost more than half its value within a few months, with a change in OPEC policy playing an important role. Also, both declines were preceded by periods of elevated prices that had spurred both increased investment and production. However, in the 1986 crash, prices had begun falling well beforehand; in 2014, they were remarkably stable before the decline (**Figure 2**).

**Figure 2: As in 1986, oil prices dropped sharply in 2014 from a previously**



Source: Bank of Canada calculations

Last observation:

A more detailed view, however, reveals important differences between both episodes. While oil demand had been falling at the start of the 1980s, demand growth during the current episode is being sustained by emerging economies and is projected to be more stable. Also, spare capacity is significantly smaller today, and the current supply is more sensitive to reductions in investment spending.

<sup>10</sup> China accounted for almost 70 per cent of the global demand increase from 2000 to 2014 and about 12 per cent of global consumption in 2014.



## Demand growth is being sustained by emerging economies during the current episode and projected to be more stable

In the early 1980s, OECD countries, which accounted for about two-thirds of global oil consumption, sharply reduced their demand for oil (**Figure 3**). The reduction between 1980 and 1985 was the result of the recession in the early 1980s, efficiency gains and substitution away from oil towards other fuels due to high oil prices in the late 1970s. This shift away from oil led to a sharp decline in the oil intensity of global GDP. Indeed, the International Energy Agency (IEA) estimates that it caused demand growth in OECD countries to fall permanently by about one-third (IEA 2006).

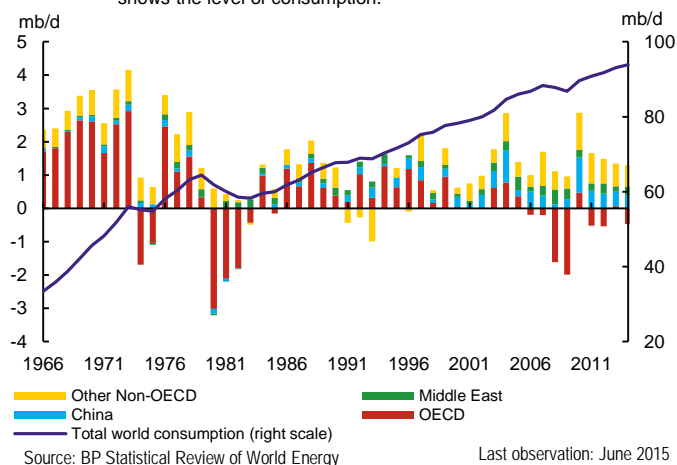
In the 1970s and 1980s, the impetus behind the decline in energy intensity was motivated in part by concerns over energy security and the fear that OPEC could raise prices at will. Today, environmental and climate concerns are weighing on OECD oil demand. However, OECD countries no longer play as important a role in the oil market as they did in the mid-1980s. Currently, growing demand from China and other developing countries in Asia and the Middle East more than offset declining OECD consumption. The IEA projects that environmental policies and efficiency gains could lead to a decline in OECD consumption of almost 4 million barrels per day (mb/d) (9 per cent) over the next decade. However, non-OECD countries will increase their demand by 10 mb/d (23 per cent).<sup>11</sup>

An interesting question is how future demand will react to low oil prices. Following the 1986 oil price decline, the reaction of demand appeared quite strong. With an additional boost from stronger economic growth, a 4 mb/d decline from 1980 to 1985 was more than reversed by a 6 mb/d increase in consumption over the following five years. According to the IEA, global oil demand in 2015 also picked up in response to low oil prices. Global oil demand growth was 1.8 mb/d in 2015, compared with just 1.0 mb/d in 2014, and is expected to be about 1.2 mb/d in 2016 (IEA 2016).

Going forward, however, the demand response to low oil prices is likely to be small compared with the pickup after the 1986 oil price decline. First, the high demand observed in the first half of 2015 was boosted by unusually high heating demand due to cold weather in Europe and parts of North America. Second, several estimates indicate that oil demand today reacts less strongly to low oil prices than in previous decades and has also become more resilient to future price increases.<sup>12</sup> The U.S. Energy Information

**Figure 3: Oil consumption has declined in the early 1980s but has been growing in the recent years**

Stacked bars show the annual changes in consumption. Black line shows the level of consumption.



<sup>11</sup> The estimate is derived from the IEA's "New Policies Scenario" in *World Energy Outlook 2015* (IEA 2015).

<sup>12</sup> See Hughes, Knittel and Sperling (2008), Dargay and Gately (2010), and Baumeister and Peersman (2013), among others. Dargay and Gately (2010) argue that this is due to world oil demand's shift towards faster-growing regions and less price-responsive products. Also, the oil intensity of GDP has fallen globally, potentially making economies less reactive to fluctuations in oil prices.

Administration (EIA) estimates that global demand growth from 2014 to 2020 will be less than 6 per cent, compared with an actual growth of more than 12 per cent between 1985 and 1990.

### Less spare capacity is available

In an unsuccessful attempt to sustain high oil prices, OPEC—or, more specifically, Saudi Arabia—cut production dramatically in the first half of the 1980s. By August 1985, Saudi Arabia was producing 3.6 mb/d, down from 10.4 mb/d in 1981 (**Figure 4**). Total OPEC spare capacity reached more than 10 mb/d by 1985, which corresponded to about 17 per cent of global production. OPEC’s market share fell from 50 per cent in the 1970s to 30 per cent in 1985 in an attempt to support the price of oil (**Figure 5**). Although this prevented an even steeper decline, prices still fell by 25 per cent between early 1981 and mid-1985. Then Saudi Arabia, noting that price pressures had become permanent and faced with fellow OPEC members who constantly exceeded their production quotas, decided to give up its role as a swing producer and slowly restored production to levels of the early 1980s. By 1991, OPEC spare capacity declined to under 2 mb/d and its global market share rebounded to more than 40 per cent (**Figure 5**).

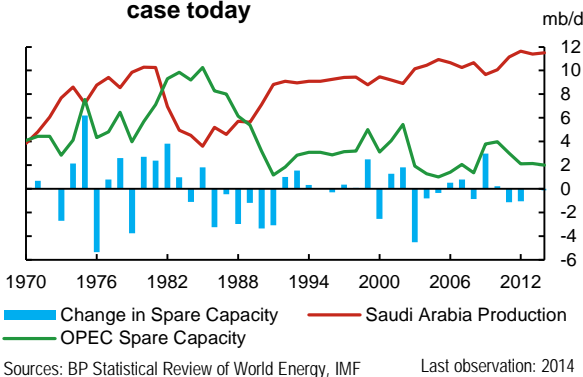
There is no parallel today to this abundance of readily available cheap oil. As of 2015, OPEC’s effective spare capacity is estimated to range between 1.5 and 2.85 mb/d, about 2 to 3 per cent of global production.<sup>13</sup>

Unless low-cost OPEC producers can develop new production capacity much sooner than expected, a sizable portion of future demand increases over the coming decade will have to be met by high-cost producers.

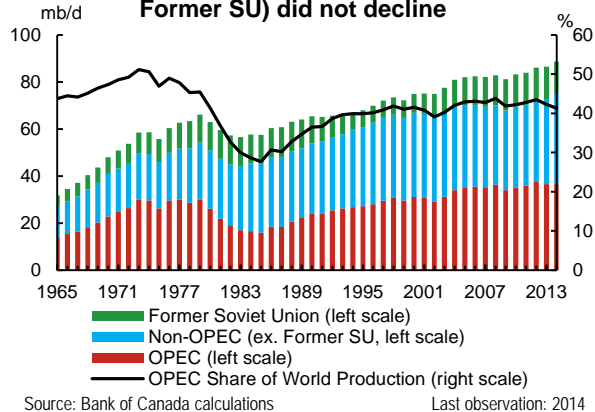
### Current supply is more sensitive to the reduction in investment spending

During the 1970s as a reaction to a period of high prices, there were large increases in exploration activity and investment, in particular in non-OPEC countries. As a result, non-OPEC countries increased their oil production from about 25 mb/d in 1975 to almost 40 mb/d in 1985. Similarly, between 2010 and 2014,

**Figure 4: OPEC had substantial spare capacity in the early 1980s, but this is not the case today**



**Figure 5: While OPEC regained market share after 1986, non-OPEC production (ex. Former SU) did not decline**



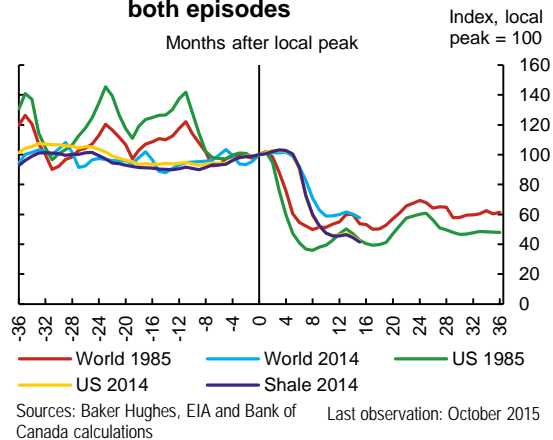
<sup>13</sup> The IEA (IEA 2016) estimates OPEC spare capacity (including spare capacity from Iraq, Nigeria and Libya) to be around 2.85 mb/d in April 2016. The EIA, using a more conservative definition of spare capacity, estimates OPEC spare capacity to average around 1.5 mb/d through 2016 (EIA 2016a).

production in non-OPEC countries grew by 4 mb/d, driven mainly by the shale revolution in the United States.

As a result of declining prices and increasing overcapacity, the oil industry slashed investment by 50 per cent between 1981 and 1987, with most of the cuts taking place after the 1986 oil price decline.<sup>14</sup> However, due to the long investment cycles of the conventional production process, the cut in capital expenditure did not materially affect production growth until 1987, when it plateaued temporarily. In particular, projects in the United Kingdom and Norway that had been planned long before still went into production after 1986 (Kesicki 2010). After a modest rebound of the oil price to \$33 (in 2014 real terms) by 1987, investment spending grew again and led to an increase in non-OPEC production outside the former Soviet Union (FSU).

The recent steep decline in the drilling rig count mirrors the experience in the mid-1980s and suggests an investment decline of a similar magnitude (**Figure 6**).<sup>15</sup> In a review of major oil producers' capital expenditure budgets from 2014 to 2016, we found that capital expenditure fell on average by 28 per cent between 2014 and 2015, and it is expected to fall another 25 per cent between 2015 and 2016.

**Figure 6: Rig counts reacted similarly across both episodes**



One important difference compared with the mid-1980s is that the average reserve decline rates are higher today.<sup>16</sup> In 2008, the IEA estimated that, compared with the pre-1970s, the average annual decline rate had gradually increased from 3 to 5 per cent in OPEC countries and from 6 to more than 14 per cent in non-OPEC countries (IEA 2008).<sup>17</sup> Due to US shale oil's rapid decline rate, these average numbers are likely to be even higher today.<sup>18</sup>

This means that, relative to the 1980s, more investment spending is necessary simply to compensate for declining output in existing fields, let alone to meet rising demand (IEA 2015). As a result, in the absence of significant investment, oil production is expected to decline more rapidly today than it did 30 years ago.

There are also factors muting the effects of reduced investment spending on output. First, production and investment costs are procyclical. These costs are falling and help support profitability and production. In

<sup>14</sup> See, for example, Kjus (2014) and Cohen (2016).

<sup>15</sup> Unfortunately, no historical investment spending data are readily available. Changes in rig count tend to give a solid indication of the changes in investment.

<sup>16</sup> The decline rate is the percentage reduction in a field's production after production has peaked. After a build-up phase, production from a given field typically declines over time, as pressure from the formation is depleted. Observed decline rates depend on geological factors such as the field size and the type of production (e.g., onshore or offshore) as well as investment and production policies.

<sup>17</sup> More precisely, the average decline rate refers to the production-weighted average post-peak observed decline rate (IEA 2008).

<sup>18</sup> US shale oil wells have very high decline rates; 70 per cent of a well's extractable oil is produced within the first year and a well can produce for only two to four years. This implies that, to simply maintain current level of oil production, a large number of new wells need to be drilled/developed to offset the loss from maturing fields.

addition, the price decline accelerates the implementation of efficiency gains, which are achieved both technically and through industry restructuring.<sup>19</sup> The same factors also helped to sustain output in the 1980s. Hence, the key difference between the current episode and 1986 episode is the decline rate, which is expected to lead to a quicker output adjustment to low investment.

## Low for Longer? Outlook and Implications for the Global Oil Market

The conditions leading to a prolonged period of low oil prices in the aftermath of the 1986 price crash, in particular the abundance of cheap oil from existing spare capacity, seem to be unique to that period. Given higher decline rates, current production should fall much more quickly compared with the past. As a result, greater investment will be necessary to meet growing demand. Since an increasing fraction of this investment will go towards higher-cost unconventional sources, this should translate into higher oil prices over the medium term.

Nevertheless, while we believe that prices will not stay below the \$50 mark for a decade or more, there are several risks that could contribute to such a scenario.

- **Stronger shale oil output:** US shale oil production has repeatedly surprised on the upside since its inception, and it may continue to do so over the coming years as technology and efficiency continue to improve. Moreover, if the technology is exported, shale production outside of the US could increase significantly.
- **OPEC increases capacity and low-cost production:** Iran and Iraq have stated production goals of 4.5 mb/d and 6 mb/d by 2020, respectively. This would roughly double the IEA's baseline forecast for OPEC output growth (IEA 2015). Lower oil prices might even induce other low-cost producers to increase exports in an attempt to compensate for lost revenue. However, some of the countries with the largest potential to increase output face financial and political uncertainties, such that important increases in long-term output will be a major investment challenge (IEA 2015).
- **Demand decreases due to substitution by non-fossil fuel energy such as renewables:** Shifts in environmental and climate change policy, alongside efficiency gains in the use of non-fossil fuels, could reduce demand growth by more than expected.

A sharp shift in environmental policy seems unlikely, yet it also poses the greatest risk of a sustained low-price environment. As long as oil demand from emerging economies remains robust, increases in production will require additional investment in high-cost production. The cost of this incremental production points to higher prices in the medium term than were observed in 2015, although the potential amount of a price increase is limited because of ongoing cost-cutting initiatives and technological advances. Due to the fundamental changes in the oil market, it is unlikely that a decade of low oil prices, similar to the experience following the 1986 oil price crash, will repeat itself.

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<sup>19</sup> See Office of Technology Assessment (OTA 1987) for the 1986 episode and IEA (2015) for the current episode. For example, IEA's Upstream Investment Cost Index has fallen by 13 per cent in 2015, relative to 2014 (IEA 2015).

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