

## BOX 4.1 What do we know about the impact of oil prices on output and inflation? A Brief Survey<sup>1</sup>

*Movements in oil prices have often been associated with changes in output and inflation. Although the effects of oil price movements on output and inflation have declined over time, they tend to be larger when prices go up (rather than down) and when they are driven by changes in oil supply (rather than demand).*

Large jumps in oil prices have historically been followed by rising inflation and recessions in many countries.<sup>2</sup> This basic observation led to a voluminous literature analyzing the complex linkages between movements in oil prices and activity and inflation. This box presents a brief review of this literature to address the following questions:

- Which key channels transmit changes in oil prices to activity and inflation?
- How large is the impact of oil price movements on activity?
- How large is the pass-through of changes in oil prices to inflation?

### Which key channels transmit oil price changes to activity and inflation?

Falling oil prices often affect activity and inflation by shifting aggregate demand and supply and triggering policy responses. On the supply side, lower oil prices lead to a decline in the cost of production (Finn, 2000). The lower cost of production across a whole range of energy-intensive goods may be passed on to consumers and hence, indirectly, reduce inflation (Blanchard and Gali 2008). The lower cost of production can also translate in higher investment. On the demand side, by reducing energy bills, a decline in oil prices raises consumers' real income and leads to an increase in consumption (Edelstein and Kilian, 2008; Kilian, 2014; Hamilton, 2009).<sup>3</sup>

If falling oil prices ease inflation—especially, core inflation or inflation expectations (Alvarez et al., 2011)—central banks may respond with monetary loosening which, in turn, can boost

activity (Bernanke, Watson and Gertler, 1997).<sup>4</sup> However, if core inflation or inflation expectations do not ease with falling oil prices, central banks may refrain from a monetary policy response such that the impact on real activity could be small (Hunt, Isard and Laxton, 2001). Lower oil prices can also lead to adjustments in fiscal policies that can in turn affect activity.

### How large is the impact of oil price movements on activity?

The literature mostly focuses on estimating the impact of oil price *increases* on real activity in major economies.<sup>5</sup> These estimates vary widely, depending on the oil intensity of the economy, oil exporter status, data samples, and methodology. For example, for OECD countries, a 10 percent increase in oil prices has been associated with a decline in real activity of 0.3-0.6 percent in the United States and 0.1-0.3 percent for the Euro Area (Jimenez-Rodriguez and Sanchez, 2005).<sup>6</sup> Similar results have also been found for developing countries.<sup>7</sup>

Recent literature has established that the effects of oil prices on activity and inflation depend on the underlying source and direction of the changes in prices. Also, the impact has declined over the years.<sup>8</sup>

*Source of the oil price movements.* The impact of oil prices on activity depends critically on their source. Oil supply shocks would be expected to generate an independent impact on activity. In contrast, oil demand shocks would themselves be the outcome of changing real activity with limited second-round effects (Kilian, 2009). Indeed, oil price changes driven by oil supply shocks are often associated with significant changes in global output and income shifts between oil-exporters and importers. Changes in prices driven by demand shocks, on the other hand,

<sup>1</sup>The main authors of this box are Derek Chen, Raju Huidrom and Tianli Zhao.

<sup>2</sup>Hamilton (2005) documents that nine out of ten recessions in the U.S. were preceded by sharp oil price increases. De Gregorio, Landierretche, and Neilson (2007) show the strong correlation between oil price shocks and subsequent high inflation in many countries.

<sup>3</sup>For example, a \$10 per barrel oil price decline may reduce U.S. consumers' gasoline bills by as much as \$30 billion (0.2 percent of GDP; Gault, 2011). However, the uncertainty associated with oil price swings can have a negative impact on investment (Elder and Serletis, 2010).

<sup>4</sup>The impact of endogenous monetary responses to oil price movements on aggregate activity is contested in the literature. For instance, Kilian and Lewis (2011) argue that, once the endogeneity of oil price movements is taken into account, there is no empirical support for a significant role of the monetary policy in amplifying the effects of oil price shocks on the U.S. economy.

<sup>5</sup>For the global economy, as mentioned in the text, Arezki and Blanchard (2014) report estimates of model simulations that the current oil price slump could increase global output by 0.3 – 0.7 percentage points. Similar estimates based on such large scale- macroeconomic models are also available from other sources (World Bank, 2013; IMF, 2014; OECD, 2014).

<sup>6</sup>Jimenez-Rodriguez and Sanchez (2005) derive these estimates from a variety of different methodologies. Their results are broadly in line with Abeysinghe (2001), Reifschneider, Tetlow and Williams (1999), and Mork (1994), Cashin, Mohaddes and Raissi (2014), and Peersman and Van Robays (2012).

<sup>7</sup>See Tang, Wu, and Zhang (2010) and Allegret, Couharde and Guillaumin (2012). In addition to changes in the level of oil prices, their volatility has been associated with a decline in investment in some developing countries, for example in Thailand (Shuddhasawtta, Salim, Bloch, 2010).

<sup>8</sup>Hamilton (2005), Kilian (2008, 2014) provide comprehensive surveys of the literature on these issues.

**BOX 4.1 (continued)**

tend to lead to weaker and, in some studies, insignificant effects (Cashin, Mohaddin, and Raissi, 2014; Kilian, 2009; Peersman and Van Robays, 2012).

*Asymmetric effects.* The failure of the 1986 oil price collapse to produce an economic boom has sparked a literature on the asymmetric impact of oil price movements on activity. Such an asymmetric effect may result from costly factor reallocation, uncertainty, and an asymmetric monetary policy response. In particular, the U.S. Federal Reserve has typically chosen to respond vigorously to inflation increases triggered by higher oil prices but has responded less to unexpected declines in inflation following oil price declines (Kilian, 2014; Bernanke, Gertler, and Watson, 1997).<sup>9</sup> Hence, while oil price increases—especially large ones—have been associated with significantly lower output in the United States, oil price declines have been followed by much smaller, and statistically insignificant, benefits to activity (Hamilton, 2003; Jimenez-Rodriguez and Sanchez, 2005).<sup>10</sup>

*Declining impact.* Several studies have documented that the impact of oil prices on output has fallen over time. For example, Hamilton (2005) estimates that a 10 percent oil price spike would reduce U.S. output by almost 3 percent below the baseline over four quarters in 1949-80 but less than 1 percent in a sample that extends to 2005. The literature has offered a variety of reasons for the declining impact of oil prices on the economy (Blanchard and Gali, 2008): structural changes such as falling energy-intensity of activity, and more flexible labor markets which lowered rigidities associated with price-markups.<sup>11</sup> In addition, stronger monetary policy frameworks have reduced the impact of oil price shocks by better anchoring inflation expectations, thus dampening firm pricing power

imports abruptly in the short-term, while benefits for importing countries could be diffuse and offset by higher precautionary savings if confidence in recovery remains low.

- *Monetary and fiscal policies.* In oil-importing countries where declining oil prices may reduce medium-term inflation expectations below target, central banks could respond with additional monetary policy loosening, which, in turn, can support growth. The combination of lower inflation and higher output implies a favorable short-run policy outcome. In oil-exporting countries, however, lower oil prices might trigger contractionary fiscal policy measures, unless

(Taylor, 2000) and helping create a regime where inflation is less sensitive to price shocks.

**How large is the pass-through of changes in oil prices to inflation?**

Historically, oil price swings and inflation have been positively correlated, even though this relationship has varied widely across countries (as documented in Figure 4.5 in the main text). Large increases in oil prices during the past forty years were often followed by episodes of high inflation in many countries (De Gregorio, Landerretche, and Neilson, 2007). As in the case of output, the impact of oil price swings on inflation has, however, declined over the years. For instance, Hooker (2002) showed that oil prices contributed substantially to U.S. inflation before 1981, but since that time the pass-through has been much smaller. Similar results have been found for other advanced economies (Cologni and Manera 2006; Alvarez et.al, 2011) and for some emerging market economies (De Gregorio, Landerretche, and Neilson, 2007; Cunado and Gracia, 2005). The decline in pass-through is attributable to the reasons above that explain the decline in the impact on activity, in particular improvements in monetary policy frameworks that resulted in better anchoring of long-run inflation expectations.

<sup>9</sup>Kilian and Vigfusson (2011) presents a survey of the literature on the nonlinearities and asymmetries in oil price-output relationship.

<sup>10</sup>Similar estimates are also found in the earlier literature (Mork et. al., 1994; Smyth, 1993; Mory, 1993).

<sup>11</sup>Barsky and Kilian (2004) and Blanchard and Gali (2008) argue that the impact of oil prices on the U.S. stagnation in the 1970s is overestimated in the earlier literature.

buffers are available to protect expenditures from the decline in tax revenues from the oil sector.

These channels operate with different strengths and lags across countries. However, it seems clear that oil price declines generally have smaller output effects on oil-importing economies than oil price increases.<sup>7</sup> This asymmetry could be caused by the frictions and adjustment costs associated with oil price changes.

<sup>7</sup>See Jimenez-Rodriguo and Sanchez (2005) for details on these findings. Hoffman (2012) provides a summary of the results in the literature.