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The 2014–16 Oil Price Collapse in Retrospect

Sources and Implications

Marc Stocker
John Baffes
Y. Modeste Some
Dana Vorisek
Collette M. Wheeler

World Bank Group
Development Economics
Development Prospects Group
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Abstract

With the benefit of hindsight, this paper provides a fresh and comprehensive look at the causes of the 2014–16 collapse in oil prices and its impact on the global economy. It disentangles the contribution of supply and demand factors, assesses the impact on activity in oil exporters and oil importers, and reviews policy responses in these countries. The main conclusions are: (i) the decline in oil prices was predominantly triggered by supply factors, particularly rapid efficiency gains in U.S. shale oil production, but softening demand prospects played a substantial role as well; (ii) the short-term benefits of falling oil prices for the global economy were muted by economic rebalancing in China, a low responsiveness of activity in other oil-importing emerging markets, and a sharp slowdown in U.S. investment as energy sector activity declined and a the U.S. dollar strengthened; (iii) oil exporters with flexible exchange rates and relatively large fiscal buffers fared better than others, but most oil-exporting economies still face significant policy challenges as their medium-term prospects for growth and fiscal revenues have deteriorated; (iv) fundamental changes in the oil market make a return to the oil price levels of the early 2010s unlikely, pointing to the need for accelerated reforms, particularly among oil exporters.

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The 2014–16 Oil Price Collapse in Retrospect: Sources and Implications*

Marc Stocker, John Baffes, Y. Modeste Some, Dana Vorisek, and Collette M. Wheeler

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* Stocker (Development Prospects Group, World Bank; mstocker1@worldbank.org); Baffes (Development Prospects Group, World Bank, jbaffes@worldbank.org); Some (Strategy, Policy, and Review Department, International Monetary Fund; msome@imf.org); Vorisek (Development Prospects Group, World Bank; dvorisek@worldbank.org); Wheeler (Development Prospects Group, World Bank; cwheeler@worldbank.org). We thank Carlos Arteta, Raju Huidrom, Atsushi Kawamoto, Seong Tae Kim, and Shane S. Streifel for their valuable contributions and Jai Chopra, Ayhan Kose, Franziska Ohnsorge, David Robinson, and Christopher Towe for comments and suggestions. Anh Mai Bui and Xinghao Gong provided excellent research assistance. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors and should not be attributed to the World Bank, its Executive Directors, or the countries they represent.

1. Introduction

The 70 percent drop in oil prices between mid-2014 and early 2016 was one of the three largest declines since World War II, and the most persistent since the supply-driven collapse of 1986. The episode marked a dramatic end to a prolonged period of elevated oil prices that began in 2003 amid rising demand from China and other major emerging market and developing economies (EMDEs).[1] The decline led to a sudden realignment of oil prices with long-term historical averages, and with other industrial commodities that had started falling in previous years (Figure 1). Despite recovering some of their losses in 2017–18, oil prices are still significantly below their 2011–14 average.

Several recent papers have looked at the specific factors contributing to the collapse in oil prices, including rising efficiency gains in U.S. unconventional oil production (Bjørnland, Nordvik, and Rohrer 2017; Newell and Prest 2017), the falling clout of the OPEC cartel (Behar and Ritz 2016), weakening oil demand (Kilian and Zhou 2017), and the adoption of more energy efficient technologies (Cherif, Hasanov, and Pande 2017).

This paper complements the existing literature by providing a comprehensive overview of the various forces at play and empirically assessing the respective contribution of supply and demand factors. It offers a detailed retrospective analysis of the impact of the 2014–16 oil price collapse on the global economy and policy responses in both oil importers and exporters.[2] It links mitigating factors for oil importers with weakening investment in China (Kang and Liao 2016) and in the U.S. energy sector (Baumeister and Kilian 2016), as well as aggravating factors for oil exporters with abrupt fiscal adjustments (Danforth, Medas, and Salins 2016) and low levels of economic diversification (Grigoli, Herman, and Swiston 2017).

The paper is organized in six sections. Section 2 examines the drivers of the 2014–16 oil price plunge, including receding geopolitical risks, surging U.S. shale oil production, policy shifts by OPEC, and weakening demand prospects. The relative contribution of demand and supply factors to the oil price adjustment are estimated with a Bayesian structural vector autoregressive model, following the identification strategies of Baumeister and Hamilton (2015) and Caldara, Cavallo, and Iacoviello (2016). Section 3 assesses the impact of sharply declining oil prices on global activity and investigates the absence of a stimulus effect despite the dominant role of oil importers in the global economy. Section 4 examines the monetary, fiscal, and structural policy responses in both oil-exporting and oil-importing economies, and highlights several facets of pre-2014 economic policy frameworks that helped cushion the blow for some oil exporters. Section 5 discusses remaining structural and macroeconomic policy challenges for oil exporters, highlighting needed reforms to boost potential growth and increase resilience to fluctuations in oil prices. Section 6 summarizes the findings and discusses long-term prospects for oil prices.

[1] China's share of global oil consumption increased from 6 percent in 2000 to 12 percent in 2014. The increase in China's metal and coal consumption share was even larger: increasing from less than 10 percent to almost 50 percent of global consumption during the same period.

[2] A country is classified as an oil exporter when, on average in 2012–14, exports of crude oil accounted for 20 percent or more of total exports. Countries for which this threshold is met as a result of re-exports are excluded. When data are not available, judgment is used. The list of oil-exporting EMDEs is presented in Appendix 1.

2. What were the main drivers of the oil price plunge?

Several key developments in the global oil market occurred prior to and during the 2014–16 price plunge: the U.S. shale oil industry became the marginal cost producer, geopolitical risks diminished, OPEC changed its policy stance, and global growth prospects deteriorated. Although supply factors appear to have been the dominant force in the sudden price collapse in 2014, weakening demand prospects were also an important contributor, particularly in 2015–16. The latter could partly explain why the oil price plunge failed to provide the anticipated boost to global activity.

2.1 U.S. shale oil production

A surge in U.S. shale oil production was one of the main drivers of the global oil supply glut that preceded the price collapse in the second half of 2014. While U.S. shale oil represents less than 6 percent of world oil output, it accounted for nearly half of the growth in global oil production from 2010 to 2014. This rapid expansion was initially underestimated, as reflected in repeated upward revisions to the outlook for U.S. oil production by the International Energy Agency (IEA).[3] It was also overshadowed by a series of supply disruptions in the Middle East, which held back global oil output. These disruptions included conflict in Libya, the impact of sanctions on the Islamic Republic of Iran, and fears of supply outages in Iraq. However, these geopolitical concerns dissipated during 2014, shale oil production continued to grow rapidly, reaching a peak of more than 5 million barrels per day (mb/d) in late 2014. That year, gains in U.S. oil production alone exceeded global oil demand growth.

The technology to extract natural gas and oil from shale formations (hydraulic fracturing and horizontal drilling) has existed for decades, but its application became widespread in the 2000s—first in natural gas, and then in oil—as prices peaked (Wang and Krupnick 2013). Such an endogenous supply response to elevated oil prices was also observed in the past. In particular, during the early 1980s, high prices led to a similar expansion of oil extraction from Alaska, Mexico, and the North Sea, which contributed to a subsequent supply glut and price collapse in 1986. During the oil price plunge, however, shale technology proved more flexible and resilient than conventional methods (Bjørnland, Nordvik, and Rohrer 2017). Production from existing U.S. shale oil wells was sustained during the price collapse, but oil rig counts—an indicator of capacity adjustments—fell nearly 80 percent, before recovering sharply thereafter (Figure 2). Overall, the response of shale oil drilling to oil price shocks is estimated to be about five times larger than the response of conventional oil drilling, reflecting greater flexibility and shorter production cycles (Newell and Prest 2017).

The resilience of the shale oil industry to lower oil prices was also echoed in rapid efficiency gains, which became increasingly evident after mid-2014. Production costs fell considerably, dropping by around 25 percent since the start of the oil price decline, reflecting the improved design of wells, shorter drilling and completion times, and higher initial production rates (Curtis 2015). Overall,

[3] From a total of 72 updates during January 2011 to December 2014, the IEA made 66 upward revisions to U.S. production over that period, implying that the organization was underestimating U.S. shale production.

efficiency gains and technological innovation in the U.S. shale industry helped increase the median output per well by a factor of six from 2012 to 2017 (EIA 2018). The combined impact of lower production costs and efficiency gains caused average breakeven prices for the shale oil industry to fall from more than $70 per barrel (bbl) in 2012 to less than $50/bbl in 2016–17 (Rystad Energy 2017). The resilience also reflects the decline in input costs (especially labor and rental equipment), as well as the ability of shale producers to hedge their entire production, as the shale oil cycle spans only a few years (as opposed to conventional oil, which spans decades).

The U.S. shale oil industry is likely to remain the marginal cost producer in coming years, and thus will continue to cap global oil prices (IEA 2017). Even if oil prices were at $30/bbl, about 50 percent of technically recoverable U.S. shale reserves would be economically viable (Smith and Lee 2017). U.S. shale oil reserves are assessed to be approximately 80 billion barrels (Bbbl), or around 20 percent of global shale reserves (EIA 2015; BP 2017). Technological improvements achieved in the United States could also stimulate faster production elsewhere. Shale reserves in the Russian Federation are close to those in the United States, at an estimated 75 Bbbl. China and Argentina follow, with 32 and 27 Bbbl of reserves, respectively. Although shale oil reserves represent around 10 percent of global oil reserves, greater flexibility in production implies that shale oil will continue to have a major effect on prices.

2.2 The role of OPEC policies

Despite the shale oil boom, oil prices remained high during 2011–14, supported by supply disruptions and heightened geopolitical concerns involving some key producers, as well as expectations that OPEC members would continue to adjust production to stabilize prices. Following the beginning of the price collapse in mid-2014, however, OPEC decided against implementing output quotas, as it had done in the past, including in 1985-86. Instead, it announced in November 2014 that its objective was to retain its market share; a policy shift that reflected the increasing clout of shale oil and reduced cohesiveness within the cartel (Behar and Ritz 2016). That decision, which defined OPEC's strategy throughout 2015 and 2016, was followed by a large and sustained decline in oil prices.[4]

Amid mounting fiscal pressures and in view of shale oil's resilience, several OPEC members, along with 10 non-OPEC countries led by Russia, agreed to revert to production cuts to shore up prices (World Bank 2016a). The initial six-month agreement, which went into effect in January 2017, was subsequently extended twice: first to March 2018 and then to December 2018. Relatively high compliance with the agreed cuts, especially by Saudi Arabia (the largest producer in OPEC) and Russia (the most important non-OPEC oil producer) contributed to the rebalancing of oil markets during 2017. However, oil markets did not react strongly following policy announcements, illustrating the diminished capacity of OPEC to influence market conditions with the U.S. shale oil industry effectively acting as the new marginal cost producer.[5]

2.3 The role of demand conditions

[4] This was comparable to OPEC's decision to reclaim market share in 1986, which contributed to a collapse in prices after unsuccessful attempts to support prices through production cuts (McNally 2017).

[5] OPEC's reduced ability to influence the oil market is also consistent with the lower price volatility experienced during and after the 2014 collapse (World Bank 2015a; Baffes and Kshirsagar 2015).

Changing demand conditions for oil, including short-run movements in market sentiment and expectations, play an important role in driving oil price fluctuations (Lippi and Nobili 2012; Alquist and Coibion 2014; Jacks and Stürmer 2016). This was particularly visible during the boom years of 2003–08, when a positive reassessment of demand prospects from EMDEs contributed to a near doubling of the real price of oil (Baumeister and Peersman 2013; Kilian and Hicks 2013). That process reversed after the global financial crisis, as long-term prospects for advanced economies, and later for EMDEs, began to be downgraded.

Evidence of the slowdown in global growth prospects became more visible around 2011, as global industrial production, goods trade, shipping freight, and major industrial commodity prices all trended downward (Figure 3; Kilian and Zhou 2017). Deteriorating growth prospects for EMDEs led to a continued decline in oil consumption expectations for these economies. Concerns about global growth prospects intensified further during 2015 and early 2016 amid signs of a simultaneous slowdown in China, major commodity-exporting EMDEs, and the United States. In January 2016, oil prices reached a 15-year low of $31/bbl.

A decline in the average oil intensity of global GDP, which has nearly halved since the 1970s, also explains an undercurrent of weakening long-term demand. By 2016, the level of oil consumption in advanced economies, which had begun to fall prior to the global financial crisis, was nearly 7 percent below its 2005 peak. Technological improvements and substitution away from oil have been significant driving factors underlying the slowdown in oil consumption since 2005.[6] In non-OECD countries, technology and environmental policies have also started to influence crude oil demand patterns. For example, China became the world's largest user of energy-efficient vehicles in 2015, reflecting, in part, policies to reduce air pollution (Ma, Fan, and Feng 2017). Although electric vehicles continue to account for a low share of global transportation, they could become an important force affecting oil demand prospects over time (Cherif, Hasanov, and Pande 2017). From a long-term perspective, technological improvements on the consumption side, along with policies to limit fossil fuel usage and increase energy efficiency, are likely to constrain demand growth, thus preventing oil prices from reverting to levels seen during the boom years (IEA 2017).

2.4 The oil price collapse: The relative importance of supply and demand

To help disentangle the contribution of supply and demand shocks around the 2014–16 collapse, a Bayesian structural vector autoregressive model is estimated (see Appendix 2 for the description). The model explores interactions between international oil prices, global oil output, and common demand indicators, such as global industrial production and metals prices, the latter of which co-move with oil prices in the presence of demand-driven shocks.[7]

Results confirm that changing supply conditions played a dominant role in triggering the initial oil price decline from mid-2014 to early 2015, explaining about 60 percent of the drop (Figure 4). These results are consistent with previous analyses (Baffes et al. 2015; Arezki and Blanchard 2015). The role of oil demand shocks, however, strengthened in the second half of 2015 and early 2016,

[6] For example, in the context of identifying the sources of the decline in CO_2 emissions in the U.S. during 1997–2013, Feng et al. (2015) concluded that the change in fuel mix and productivity improvements played a key role in the lower use of oil.
[7] The selected identification method uses a combination of sign restrictions and bound estimates of short-term elasticities of oil supply and oil demand (Baumeister and Hamilton 2015; Caldara, Cavallo, and Iacoviello 2016).

when global activity showed signs of deceleration and metals prices continued to slide. Around that period, changes in supply conditions are estimated to have accounted for about 30 percent of the price drop. Various other indicators used to proxy demand shifts in commodity markets also point to downward demand pressures on oil prices (Kilian and Zhou 2017).

3. How did the recent oil price collapse impact the global economy?

The plunge in oil prices that began in mid-2014 led to expectations of global growth windfalls (Arezki and Blanchard 2015; Baffes et al. 2015; IMF 2014; OECD 2014). Estimates produced at the time suggested that a 50 percent supply-driven decline in oil prices could lift global GDP by around 0.8 percent over the medium term. Such a boost to global aggregate demand was expected to result from a transfer of income and wealth from oil-exporting economies, which tend to have a high aggregate savings rate, to oil-importing economies, where the propensity to spend is higher. And while lower oil prices were anticipated to negatively impact investment in the oil industry, this was expected to have been more than offset by lower energy costs for consumers and for energy-intensive sectors, including transportation, manufacturing, and agricultural sectors.

The oil price plunge, however, was accompanied by a global slowdown (Figure 5). Global growth moderated from 2.9 percent in 2014 to 2.8 percent in 2015, before dropping to a post-crisis low of 2.4 percent in 2016, amid weakening global trade and subdued capital flows to EMDEs, and broad-based weakness in commodity prices. A sudden contraction in government spending, domestic demand, and imports in oil-exporting economies had some dampening effects, but the most important factor behind disappointing global growth during and after the oil price plunge was a failed recovery in oil-importing EMDEs and advanced economies, particularly the United States. Growth disappointments among oil importers were partially reversed in 2017, as a broad-based cyclical recovery got underway. However, forecast downgrades continued among a number of oil-exporting EMDEs. Overall, global growth was overestimated by an average of 0.2 percentage point per year over the period 2014–17, with 50 percent explained by oil-exporting EMDEs, 35 percent by oil-importing EMDEs, and the remainder by advanced economies.

While country-specific factors and offsetting forces help explain the absence of a positive impulse for the global economy, the nature and amplitude of the oil shock itself might have played a role. First, the decline in oil prices was partly driven by weakening demand prospects, hence limiting the associated stimulus effect for the global economy. For instance, purely demand-driven declines in oil prices, as observed during major global slowdown episodes, have had a net negative impact on activity in oil-importing economies, including in EMDEs (Aastveit, Bjørnland, and Thorsrud 2014; Caldara, Cavallo, and Iacoviello 2016).

Second, oil price shocks could have asymmetric effects. In particular, the positive effect of an oil price decline on activity in oil importers is likely smaller than the negative effect of an equivalent increase in the oil price (Hamilton 2009, 2011). Frictions in the reallocation of factors of production between sectors, as well as the related loss of specialized labor and capital, are generally put forward as the source of such asymmetric effects. The fact that the decline in oil prices between June 2014 and January 2016 was one of the three largest since World War II, and the most persistent since 1986, implies that associated adjustment costs might have been particularly sizeable, overshadowing benefits for oil importers, at least temporarily.

While the impact of low oil prices on growth in oil-importers was less than expected, lower oil prices have helped reduce vulnerabilities in some of these countries, particularly among EMDEs. This was reflected in improved current account positions and lower inflation in countries with prior vulnerabilities, which helped support investor confidence and allowed monetary policy authorities to regain some space for policy easing (World Bank 2016b).

3.1 Impact on oil exporters

The oil price plunge had broad-based and long-lasting effects on economic activity in oil exporters. Nearly 70 percent of oil-exporting EMDEs registered slowing growth in 2015 and 2016, and most of them experienced a sharp deceleration in private consumption and investment (Figure 6).

The plunge quickly depleted oil revenues, forcing abrupt cuts in government spending that accentuated the slowdown in private sector activity in many regions (World Bank 2016b, 2016c, 2017a; Danforth, Medas, and Salins 2016). This effect was amplified in countries that entered the most recent oil price decline with weaker fiscal positions and higher private sector debt than in previous episodes. This contributed to a more pronounced slowdown in aggregate demand, particularly in investment in the Middle East, Sub-Saharan Africa, and Eastern Europe (BIS 2016).

Idiosyncratic factors, including sanctions against Russia, geopolitical tensions in the Middle East, and conflict and deteriorating security conditions in some low-income Sub-Saharan producers (e.g., Chad, South Sudan) also exacerbated the impact of the oil price shock in the affected countries. In turn, economic headwinds in Russia and members of the Gulf Cooperation Council (GCC) had adverse cross-border spillover effects through reduced trade flows, remittances, foreign direct investment, and grants (World Bank 2015b, 2016d).

In general, activity in oil exporters with floating exchange rate regimes and a relatively high degree of economic diversification recovered more quickly from the fall in oil prices than those with fixed exchange rates and less diversification. Oil exporters with large foreign reserves and more stable inflation also showed greater resilience (Grigoli, Herman, and Swiston 2017; World Bank 2016b). High income inequality and political instability also weakened the ability of oil-exporting economies to weather low oil prices (Ianchovichina and Onder 2017).

Medium-term growth prospects for oil exporters have also deteriorated following the oil price collapse. Investment growth tends to respond particularly strongly to a deterioration in terms of trade, which, in turn, negatively affect capital accumulation and total factor productivity growth (World Bank 2017a, 2018a). This dampening effect on potential output growth can be particularly strong in less diversified economies (Aslam et al. 2016).

3.2 Impact on oil importers

Contrary to expectations in 2014–15, the collapse in global oil prices did not provide a boost to activity among oil-importing economies, most of which experienced slowing growth in 2015–16 (Figure 7). Growth disappointments were concentrated in EMDE oil importers, but an unexpected slowdown in the United States in 2016 also had an outsized effect. Adjustment costs and uncertainty associated with large oil price changes could have disrupted activity and investment in the short term (Hamilton 2011; Jo 2014). The most important factors behind the lack of a positive growth response to lower oil prices are assessed to be the following:

China's energy mix and rebalancing needs. China is the second-largest oil importer in the world after the United States, but the share of oil in its overall energy consumption is the lowest among G20 economies. Instead, China relies heavily on coal, which accounted for 65 percent of energy consumption in 2016. Regulated fuel costs and a low energy and transportation weight in consumer baskets also mean that lower oil prices lead to limited real income gains for consumers (World Bank 2015c). Thus, the direct impact of the oil price plunge on China was relatively modest. Meanwhile, a near halving of investment growth since 2012 has weighed significantly on activity, and is estimated to have accounted for 40 to 50 percent of the import deceleration in 2014–15, with significant knock-on effects for trading partners (Kang and Liao 2016). Since much of investment is resource-intensive, the impact of slower investment growth was particularly significant for industrial commodity prices and activity in commodity-exporting EMDEs (World Bank 2016b; Huidrom, Kose, and Ohnsorge 2017).

Lower sensitivity of other oil-importing EMDEs to oil shocks. A number of recent empirical studies suggest that activity in oil-importing EMDEs is less responsive to oil supply shocks than that in major advanced economies (Aastveit, Bjørnland, and Thorsrud 2014; Caldara, Cavallo, and Iacoviello 2016). These studies explore several factors, including different energy mixes, consumption patterns, and energy price controls that limit the pass-through of world prices to domestic retail prices. Since many oil-importing EMDEs took advantage of lower world prices to reduce energy subsidies, real income gains from declining oil prices for consumers were more limited.

For non-oil commodity exporters, which represent approximately half of oil-importing EMDEs, adjustments to past terms-of-trade shocks continued to weigh heavily on activity in 2014–16.[8] Because investment has responded strongly to deteriorating terms of trade since 2011, both actual and potential output growth may have been negatively affected (World Bank 2017b). Some oil-importing EMDEs had also made significant investments in new oil production capacity and biofuels during the period of high oil prices, including in a number of low-income countries (World Bank 2015d). The reduced profitability of these projects as prices collapsed led to a sharp contraction in capital expenditures in those sectors. The fact that oil-importing EMDEs have become a major source of global growth and international spillovers could help explain the lack of a global stimulus effect from falling oil prices (Huidrom, Kose, and Ohnsorge 2017).

The impact of low oil prices on investment in the United States. In the United States, the boost to private consumption from lower oil prices was partly offset by a sharper-than-expected contraction in capital spending in the energy sector (Baumeister and Kilian 2016). Mining investment was cut in half in the two years that followed the mid-2014 oil price plunge. This dragged private investment down, curtailing GDP growth by 0.2 percentage point in both 2015 and 2016. The collapse of energy investment reflected both the magnitude of oil price changes and the specific nature of shale oil production, where capital expenditures are more price elastic than conventional production (Bjørnland, Nordvik, and Rohrer 2017; Newell and Prest 2017). U.S.

[8] A country is classified as "non-oil commodity exporter" when, on average in 2012–14, either (i) total commodities exports accounted for 30 percent or more of total exports; or (ii) exports of any single commodity other than energy accounted for 20 percent or more of total exports. The classification of EMDEs into energy exporters, non-energy commodity exporters, and commodity importers is presented in Appendix 1.

business activity was also dampened by the sharp appreciation of the U.S. dollar, which adversely affected manufacturing exports and profits.

4. What was the policy response in oil exporters and oil importers?

The sharp oil price decline elicited widely different monetary, fiscal, and structural policy responses in oil-exporting and oil-importing economies. Monetary policy and fiscal policy were nearly universally tightened among oil-exporting EMDEs, while the policy response in oil importers was varied. Among oil-exporting EMDEs, those with flexible exchange rates or lower-than-average reliance on oil for government revenue experienced less abrupt deterioration in fiscal balances than those with fixed exchange rates or higher-than-average reliance on oil revenues. The oil price plunge encouraged reforms in a number of oil exporters, but more efforts are required to meet diversification needs and reinforce fiscal and monetary policy frameworks. Although some oil-importing EMDEs took advantage of the period of depressed oil prices to reform energy subsidies, there has been no noticeable improvement in fiscal sustainability since 2014.

4.1 Policy response in oil exporters

Monetary policy

Many oil-exporting EMDEs experienced either sharp currency depreciations or rapid declines in foreign exchange reserves in 2014–16. Countries with floating exchange rate regimes were better able to stabilize reserves, but generally suffered sharper initial depreciations (Figure 8). Monetary authorities in several countries intervened in foreign exchange markets to support their currencies (e.g., Angola, Azerbaijan, Bolivia, Kazakhstan, Malaysia, Nigeria, Russia, Sudan, Turkmenistan), while many raised policy interest rates to contain inflation amid large currency depreciations (e.g., Angola, Azerbaijan, Colombia, Ghana, Kazakhstan, Nigeria, Russia, Trinidad and Tobago) or to support currency pegs (e.g., Bahrain, Kuwait, the United Arab Emirates).

The erosion of foreign exchange reserves forced some currency devaluations and encouraged a shift to more flexible exchange rate regimes in a number of countries (e.g., Azerbaijan, Nigeria, Russia). In contrast, GCC countries used their large supply of reserves to maintain currency pegs, despite intermittent exchange rate pressures (World Bank 2016c).

Central banks in oil-exporting EMDEs also took steps to mitigate tightening banking sector liquidity. In some countries, sovereign wealth and pension funds were used to reduce liquidity pressures in the banking sector (e.g., Azerbaijan, Kazakhstan; Sommer et al. 2016).

In oil-exporting advanced economies, Canada and Norway, inflation remained better anchored than in EMDEs. In light of weakened growth prospects, monetary authorities in these countries were able to pursue accommodative monetary policy—each lowered policy rates two times during 2015—as a complement to an easing fiscal stance.

Fiscal policy

Many oil-exporting EMDEs undertook fiscal consolidation measures to realign spending with revenues despite rising economic slack and diminishing long-term growth prospects (e.g., Algeria, Angola, Azerbaijan, Iraq, the Islamic Republic of Iran, Kuwait, Nigeria, Russia, Saudi Arabia, the

United Arab Emirates; Danforth, Medas, and Salins 2016). Compared with previous episodes of declining oil prices, the impact on public finances in EMDE oil exporters during the 2014–16 episode was larger, reflecting the magnitude and duration of the oil price decline. The effect was compounded in some countries by weaker initial fiscal positions. Fiscal sustainability gaps continued to widen in 2015 and 2016, and government debt ratios rose on average by 11.4 percentage points, compared with an average of only 0.9 percentage point in past episodes (IMF 2017a; World Bank 2017a).

The deterioration in budget deficits and fiscal sustainability gaps was greater in oil-exporting EMDEs with higher reliance on oil-related revenues, while countries with more flexible exchange rate regimes generally fared better, in part because real exchange rate depreciation mitigated revenue declines and spurred needed adjustment within the private sector (Figure 8). A number of oil exporters that had previously built up buffers in sovereign wealth funds (SWFs) used such buffers to alleviate fiscal and exchange rate pressures (e.g., Algeria, Azerbaijan, Kazakhstan, Kuwait, Saudi Arabia, the United Arab Emirates; World Bank 2015d). Others chose to issue debt on international markets, as borrowing costs were low (Lopez-Martin, Leal, and Martinez 2016; Alberola- Ila et al. 2017).

Several countries also implemented tax reforms to compensate for the loss of government revenues and to insulate such funds from future oil price fluctuations. For instance, goods and services or value-added taxes were introduced (e.g. Malaysia, Saudi Arabia, the United Arab Emirates), while existing VAT rates were raised (Colombia). However, implementation has stalled in some cases (e.g., Bahrain, Kuwait, Oman, Qatar), while exemptions have limited revenue growth in others (Malaysia).

Expenditure cuts and tax hikes have helped lower the fiscal breakeven oil price in oil-exporting EMDEs since 2015, although the breakeven price remains higher than the medium-term forecast of $65/bbl in some countries (e.g., Bahrain, Saudi Arabia, Oman, the United Arab Emirates; Baffes et al. 2015; World Bank 2017b, 2017c, 2018b).

In oil-exporting advanced economies (e.g., Canada and Norway), the availability of fiscal buffers provided space to loosen fiscal stances, as measured by changes in the structural budget balance (i.e., the budget balance adjusted for the gap between actual and potential output levels). For example, Norway’s fiscal rule allows up to 4 percent of its SWF to be drawn down to fund fiscal deficits. This provided a countercyclical policy tool to support growth.

Structural policy

The collapse in oil prices provided impetus for reforms, particularly of energy subsidies. In countries where such reforms were undertaken, energy subsidies represented nearly 6 percent of GDP before the 2014–16 oil price collapse. Between mid-2014 and end-2016, more than half of oil-exporting EMDEs introduced subsidy reforms, including the Middle East and North Africa (Algeria, Bahrain, Islamic Republic of Iran, Iraq, Kuwait, Oman, Qatar, United Arab Emirates, Saudi Arabia, Yemen), Sub-Saharan Africa (Gabon, Ghana, Nigeria, Sudan), East Asia (Bahrain, Malaysia), Latin America (Trinidad and Tobago), and Central Asia (Kazakhstan, Turkmenistan). Several oil exporters have reduced utility subsidies as well. In some cases—for instance, in GCC countries—subsidy reform was a significant break from past policy (Krane and Hung 2016; World Bank 2017b).

The aim of these reforms was to restore fiscal space, discourage wasteful energy consumption, and generate capacity for programs that better target the poor (IMF 2017b). Encouragingly, the design and implementation of recently-implemented energy subsidy reforms have been superior to past efforts, which were poorly phased in and hampered by insufficient communication to the public about the rationale behind the changes (Clements et al. 2013; Asamoah, Hanedar, and Shang 2017). In many cases, recent reforms have also included measures to mitigate the impact on the poor and to strengthen social safety nets (e.g., Algeria, Angola, Saudi Arabia).

Beyond subsidy reforms, several large oil-exporting EMDEs have also laid out medium- to long-term plans to reduce reliance on the energy sector. Examples include: reducing labor market rigidities (e.g., Oman, Saudi Arabia), supporting foreign investment (e.g., Saudi Arabia), expanding infrastructure investment (e.g., Malaysia), and improving the business environment (e.g., Algeria, Bahrain, Brunei Darussalam, Kazakhstan, Nigeria; Figure 9). However, in some cases, the structural reform agenda has faced legislative or implementation delays (e.g., Algeria, Kazakhstan) or has been scaled back as fiscal pressures receded (e.g., privatization efforts in Russia).

4.2 Policy response in oil importers

Monetary policy

The plunge in oil prices, coupled with a weak global growth environment, exacerbated the existing disinflation trend in many oil-importing EMDEs. In this context, several central banks cut interest rates, or otherwise pursued accommodative monetary policy, during 2015–16 (e.g., China, Croatia, Dominican Republic, Hungary, India, Pakistan, Poland, Romania, Thailand). Yet, a number of non-oil commodity exporters raised rates during part of the 2015–16 period because they experienced significant currency depreciation, in part due to increasing concerns about external vulnerability (e.g., Brazil, Kenya, Mongolia, Peru, South Africa, Uganda, Ukraine, Zambia) and above-target inflation (e.g., Brazil, Mexico, Peru, Sri Lanka, Ukraine).

For major advanced economies, the fall in oil prices coincided with a further drop in long-term inflation expectations. This raised concerns about persistent deflationary pressures, particularly in the Euro Area and Japan (Arteta et al. 2016). With these economies experiencing interest rates close to their lower bounds before the oil price collapse, reduced inflation expectations could have resulted in upward pressures on real interest rates. Central banks in both the Euro Area and Japan responded to deflationary risks by pursuing more aggressive monetary policy accommodation, including negative interest rate policies and expanded asset purchase programs. These steps helped to support an acceleration of activity.

Fiscal policy

Lower oil prices were expected to provide oil importers an opportunity to rebuild fiscal space, but fiscal positions instead worsened in a number of these countries over the period 2014–16 (e.g., Argentina, Brazil, Turkey). In fact, cyclically-adjusted fiscal balances of oil-importing EMDEs deteriorated significantly and government debt ratios increased. In some cases, this reflected the effects of the broader decline in commodity prices, which reduced government revenues and necessitated spending cuts (e.g., Mongolia, Mozambique, Namibia, Rwanda, Ukraine). But even in countries where growth remained relatively robust and output gaps positive, governments missed the opportunity of lower energy prices to rebuild necessary fiscal space (Kose et al. 2017).

For advanced economies, fiscal stances continued to tighten in 2014–15, on average, but then became slightly expansionary in 2016, amid concerns about persistently weak growth and increasingly constrained monetary policies (IMF 2017a). Lower oil prices implied more limited direct fiscal windfalls in advanced economies compared to EMDEs given the smaller prevalence of subsidies (Coady et al. 2017; IEA 2016).

Structural policy

Like oil-exporting EMDEs, oil-importing EMDEs have taken advantage of declining oil prices to begin dismantling energy subsidies—such subsidies tend to benefit high-income earners, crowd out public investment, and encourage more intensive use of fossil fuels (Arze del Granado, Coady, and Gillingham 2012). Since mid-2014, several countries have implemented such reform (e.g., China, the Arab Republic of Egypt, Mexico, Morocco, Tunisia), while others have raised energy taxes (e.g., China, Rwanda, South Africa, Vietnam; IEA 2015; IMF 2016; Kojima 2016). These steps have also included measures to avoid energy subsidies re-emerging if oil prices rebound—vis-à-vis automatic pricing mechanisms or full energy price liberalization (e.g., China, Côte d'Ivoire, India, Jordan, Madagascar, Mexico, Thailand, Ukraine; Asamoah, Hanedar, and Shang 2017; Beylis and Cunha 2017).

5. What are the remaining challenges for oil exporters?

The prospect of persistently low, and perhaps more volatile, oil prices intensifies the need for improved monetary and fiscal policy frameworks. It also underscores the urgency for reforms to reduce reliance on oil, increase value added and productivity in the non-extractive sector, and boost competitiveness, skills acquisition, and adaptability.

Monetary policy

Reforms to monetary policy frameworks could help foster resilience to oil price fluctuations, limiting procyclicality and ensuring smoother exchange rate adjustments (Frankel 2018; Torvik 2018). For countries with floating exchange rate regimes, options include targeting the domestic-currency price of exports, the GDP deflator, or even nominal GDP (Frankel 2010; Catao and Chang 2013). These options are viewed as delivering higher welfare gains and stability compared to policies that target consumer price inflation.

Countries with currency pegs—especially small open economies with limited financial market depth—could also see advantages by adding oil prices as part of their targeted currency basket. Irrespective of currency regimes, a criterion for judging whether monetary policy is appropriately countercyclical is whether the nominal exchange rate is allowed to move in line with terms-of-trade shocks.

Fiscal policy

Fiscal reforms also remain necessary in a majority of oil-exporting EMDEs. Only one-fourth of oil-exporting EMDEs have fiscal rules to smooth the impact of oil price cycles on activity and public finances. This suggests the need for stronger fiscal frameworks to help reduce procyclicality and to establish a firmer foundation for long-term fiscal sustainability (Mendes and Pennings 2017; Devarajan 2017). Oil price hedging and indexation of government bonds to oil prices could also help reduce exposure to short-term fluctuations in oil prices (Frankel 2017).

Diversification

Over the medium term, diversification away from oil will be needed to raise GDP per capita and improve growth prospects for oil-exporting EMDEs (Beck 2018; Gylfason 2018). Cross-country studies underscore that greater diversification of exports and government revenues bolsters long-term growth prospects and resilience to external shocks (Lederman and Maloney 2007; Hesse 2008; IMF 2016). At present, oil-exporting EMDEs exhibit a much higher degree of export concentration than oil-importing EMDEs and advanced economies (Figure 9).

The successful diversification experience of some energy producers (e.g., Malaysia, Mexico) suggests the need for both vertical diversification in oil, gas, and petrochemical sectors, as well as horizontal diversification beyond these sectors. This involves reforms to improve the business environment, education, and skills acquisition (Callen et al. 2014). Attracting capital flows to non-resource sectors may also encourage such efforts. While incremental diversification around resource sectors can help foster learning and the adoption of new technologies, proper regulatory and institutional conditions need to be in place to attract new investments, help the development of higher value-added export sectors, and boost participation in regional and global value chains. Regulations and institutions that slow the emergence of new sectors should be identified and reformed to support efficiency-seeking and productivity-enhancing investments (Mahmood 2017).

6. Conclusion and implications for the future

The plunge in oil prices from June 2014 to January 2016, one of the three largest declines since World War II, had an unexpected impact on global activity and generated a host of policy responses in oil-exporting and oil-importing economies. The key takeaways of the paper are as follows:

- Supply factors appear to have played a predominant role, particularly during the first stage of the price drop, from mid-2014 to early 2015. Rising production and efficiency gains in U.S. shale oil, diminishing supply disruptions in the Middle East, and OPEC's decision in November 2014 to abandon price controls amplified market perception of a significant supply glut. However, disappointing global growth during the second stage, from mid-2015 to early 2016, meant that demand factors also played a significant role during this period.

- The oil price plunge failed to provide the expected boost to activity, as global growth slowed in 2015 and 2016. Despite a robust upturn in 2017, global growth was overestimated by an average of 0.2 percentage point per year over the period 2014–17, of which 50 percent was explained by oil-exporting EMDEs, 35 percent by oil-importing

EMDEs, and the remainder by advanced economies. In oil importers, the shortfall reflected the low responsiveness of activity to falling oil prices, ongoing economic rebalancing in China, and the dampening impact of a sharp contraction in U.S. energy investment and a rapid appreciation of the U.S. dollar on growth in the United States. Growth slowdowns in oil exporters were sharper and longer-lasting than expected, contributing to global growth shortfalls despite the limited size of these economies.

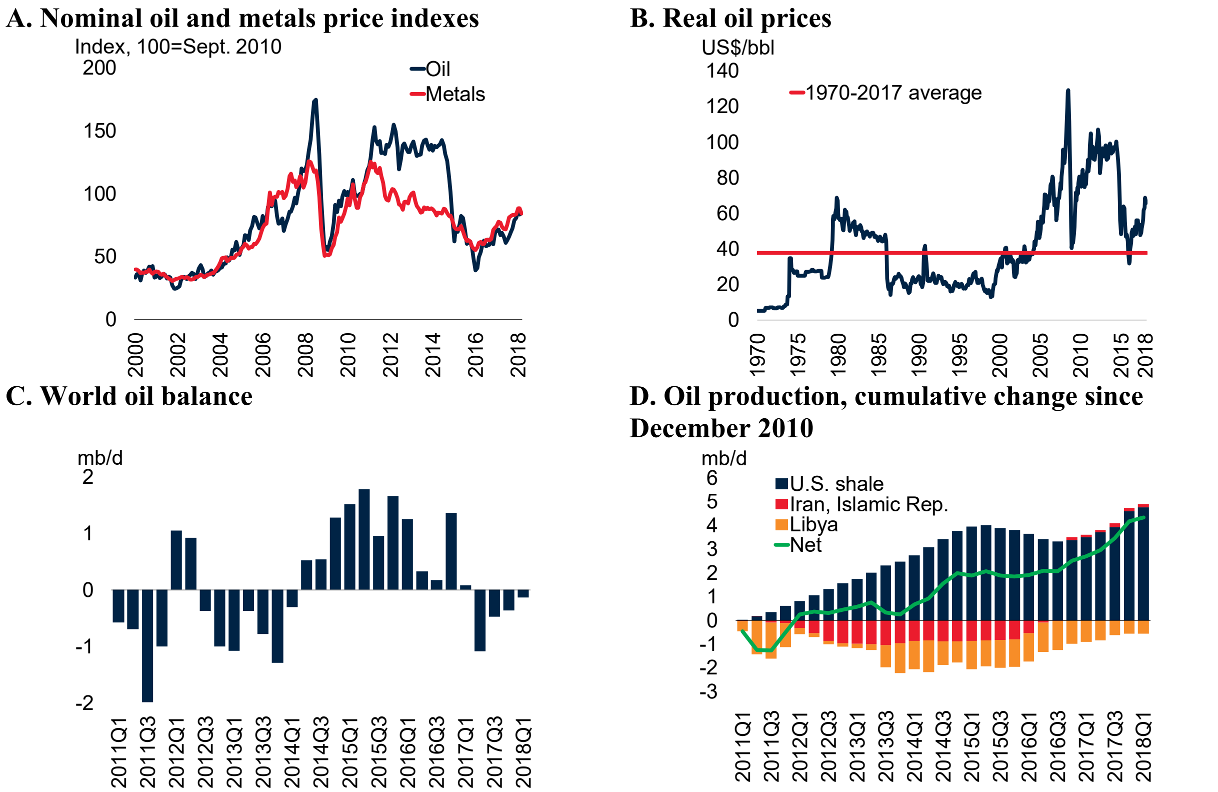
- The collapse in oil prices triggered varying policy responses. Oil exporters faced a challenging landscape after the oil price collapse, as growth prospects deteriorated, currency pressures increased, and fiscal buffers were depleted. However, economies with flexible currency regimes, relatively large fiscal buffers, and more diversification fared better than others. In addition, the period of low oil prices has compelled policymakers in many oil-exporting economies to begin to undertake long-needed reforms, including reducing fiscally costly energy subsidies and developing plans to reduce reliance on the energy sector. Several oil-importing EMDEs have also lowered energy subsidies on fiscal and environmental grounds.

The likelihood of oil prices remaining markedly below pre-2014 levels underscores the urgency of continued policy adjustment, particularly in oil exporters. Despite oil prices recovering to more than $70 per barrel at the start of 2018, fundamental changes in the oil market in recent years make it unlikely that prices will rise much more (Figure 10). In particular, shale oil has altered long-term price expectations, increasing global recoverable oil reserves and turning energy scarcity concerns in the late 2000s into a supply glut.

Oil price forecasts in 2014, which envisioned the Canadian oil sands as the world's marginal oil supplier, projected a nominal oil price of $100/bbl in 2025. Since then, technological advancements and rising productivity in the U.S. shale oil industry, coupled with efficiency improvements on the consumption side and substitution away from oil, have brought the 2025 nominal oil forecast down to $65/bbl. This said, oil supply shocks (notably geopolitically-driven disruptions) or demand shocks (especially from large EMDEs, such as India and China, where most demand growth is expected to originate) could still trigger sharp fluctuations in oil prices and overshooting in both directions (Arezki et al. 2017).

The episode of falling oil prices in 2014–16 illustrates that large price changes can have disruptive effects on global activity, including by discouraging investment in both energy and some non-energy sectors. For oil exporters, the oil price plunge has cast a long shadow, as significant declines in investment and output tend to lead to weaker potential output growth in subsequent years. The expectation that oil prices will remain markedly lower than previously projected increases the urgency of accelerating diversification efforts, boosting resilience, and increasing fiscal sustainability. The possibility of significant fluctuations in oil prices also emphasizes the need to reinforce fiscal rules and ensure that monetary policy frameworks facilitate orderly adjustments and limit adverse effects on activity.

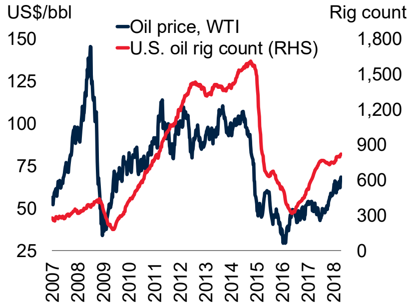
Figure 1. The oil price plunge of 2014–16 in perspective



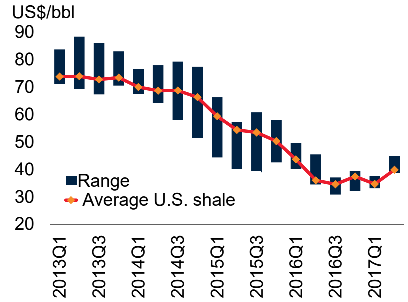
Sources: Energy Information Administration, International Energy Agency, World Bank.
A. Last observation is March 2018.
B. Real oil prices are calculated as the nominal price deflated by the international manufacturers unit value index, in which 100=2010. World Bank crude oil average. Last observation is March 2018.
C. Oil supply balance is the difference between global oil production and consumption, in million barrels per day (mb/d). Last observation is 2018Q1.
D. Last observation is 2018Q1.

Figure 2. U.S. shale oil activity and OPEC policy

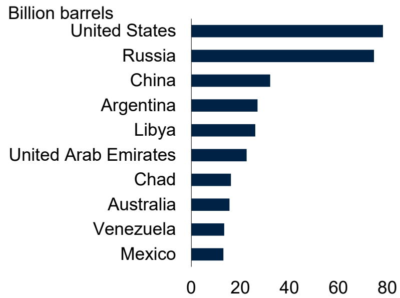
A. U.S. oil rig count and oil prices



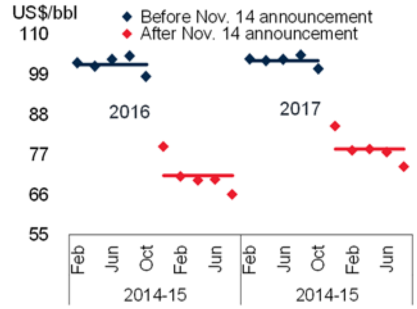
B. Average wellhead breakeven oil price



C. Global shale oil resource assessments



D. Brent oil price forecasts around OPEC decision in November 2014



Sources: Baker Hughes, Bloomberg, Consensus Economics, Energy Information Administration, Rystad Energy NASWellCube Premium.

A. Weekly data. Last observation is April 20, 2018. WTI is West Texas Intermediate.

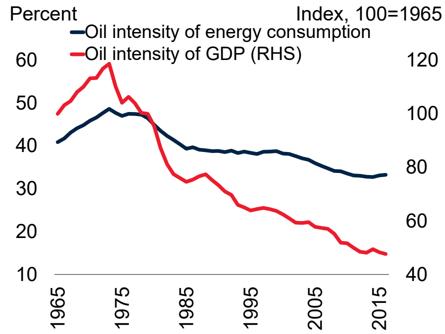
B. Does not include test activity. Last observation is 2017Q2.

C. Technically recoverable oil from low permeability tight formations, which includes shale. Data as of September 24, 2015.

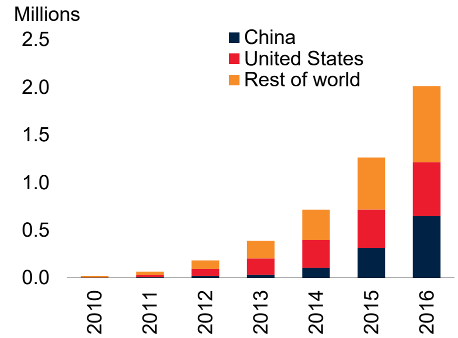
C. Median Brent oil price forecasts reported from February 2014 through August 2015.

Figure 3. Oil demand trends

A. Oil intensity of GDP and energy consumption



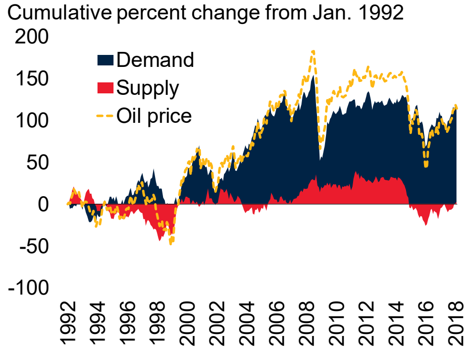
B. Global stock of electric cars



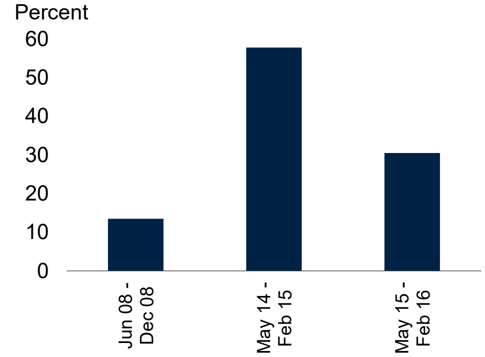
Sources: BP Statistical Review of World Energy, International Energy Agency Global EV Outlook, World Bank.
A. Oil intensity of energy consumption measured as oil consumption in percent of total primary energy consumption. Oil intensity of real GDP measured as oil consumption relative to real GDP. Last observation is 2016.
B. Electric car stock includes battery-electric vehicles and plug-in hybrid electric vehicles.

Figure 4. Contribution of oil supply and demand shock

A. Oil price decomposition



B. Share of oil price decline driven by supply shocks



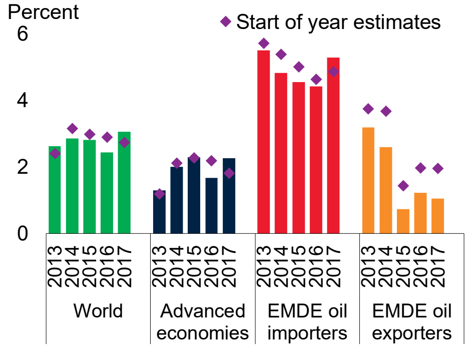
Source: World Bank.

A. B. Based on the decomposition of oil price changes from a structural vector autoregressive (SVAR) model including global industrial production, global oil production, and oil and metals prices. The identification scheme is comparable to that suggested in Caldara, Cavallo, and Iacoviello (2016), putting restrictions on short-term oil supply and demand elasticities based on a survey of the literature.

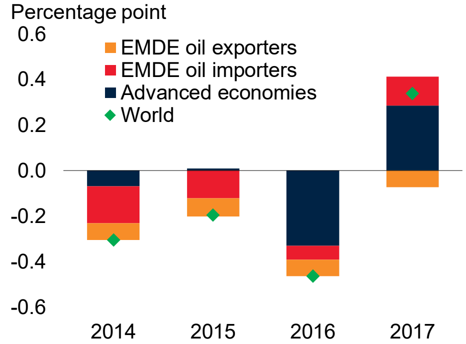
A. Last observation is February 2018.

Figure 5. Global activity

A. Growth by country groups



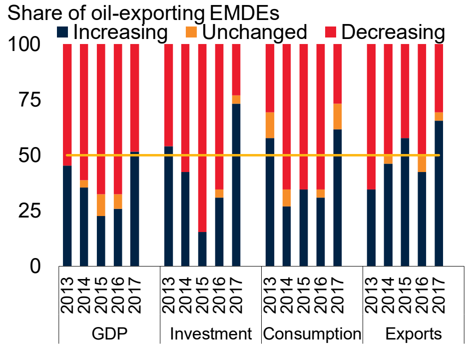
B. Contribution to global growth forecast errors



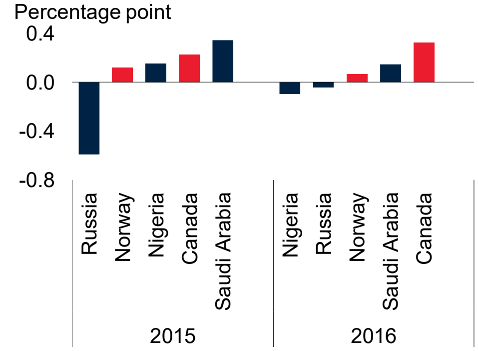
Source: World Bank.
A. B. Aggregate growth rates calculated using constant 2010 U.S. dollar GDP weights. Country classification is presented in Appendix 1.
A. Purple diamonds correspond to growth forecasts at beginning of each calendar year from *Global Economic Prospects*. Bars represent actual data up to 2016 and estimates for 2017.
B. Forecast errors computed as the difference between actual global growth and forecasts at the beginning of each calendar year. Sample includes the 153 countries with forecast data available in 2014.

Figure 6. Activity in oil-exporting EMDEs

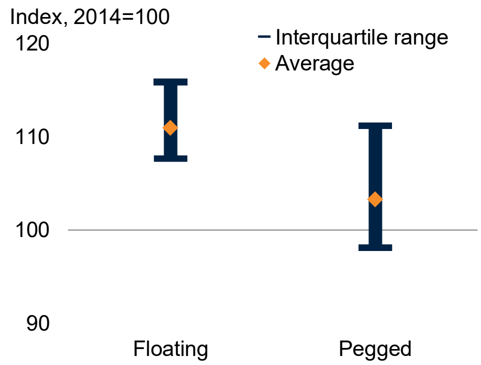
A. Share of oil-exporting EMDEs with increasing/decreasing growth



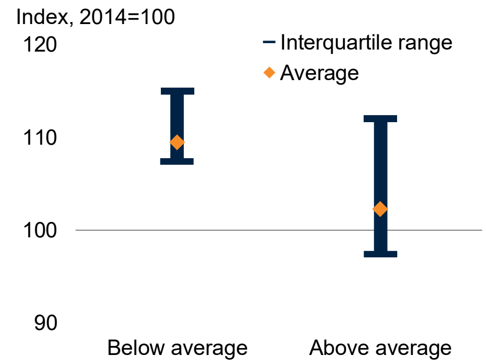
B. Contribution to oil exporter growth



C. GDP changes since 2014, by exchange rate classification



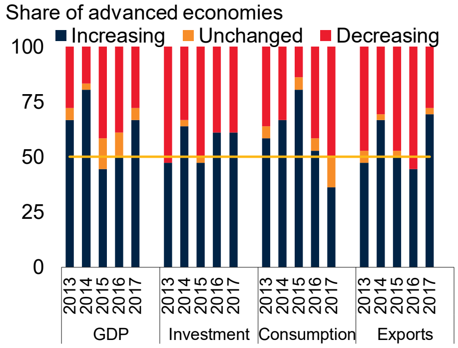
D. GDP changes since 2014, by export concentration



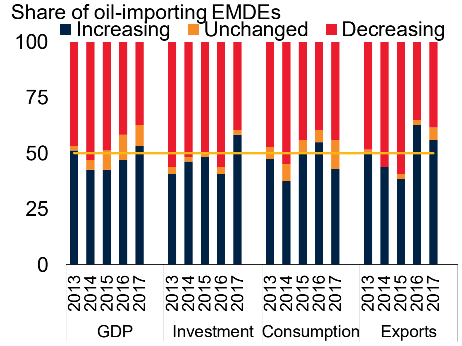
Sources: International Monetary Fund, United Nations Conference on Trade and Development (UNCTAD), World Bank.
A. Aggregate growth rates calculated using constant 2010 U.S. dollar GDP weights. Increasing/decreasing growth are changes of at least 0.1 percentage point from the previous year. Countries with a slower pace of contraction from one year to the next are included in the increasing growth category.
B. Blue bars indicate EMDEs, red bars indicate advanced economies.
C. D. Sample includes 31 oil-exporting EMDEs. Figures show average and range for each category.
C. Exchange rate classification is based on the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions database, in which countries are ranked 0 (no separate legal tender) to 10 (free float). "Hard and soft pegs" refers to countries with a ranking of 1 to 6, while "floating" denotes those with rankings of 7 to 10 and includes countries with horizontal bands and other managed arrangements.
D. "Above average concentration" and "below average concentration" groups are defined by countries above or below the sample average for export concentration in 2014. Concentration index measures the degree of product concentration, where values closer to 1 indicate a country's exports are highly concentrated on a few products. The average for the sample is 0.6, where 1 is the most concentrated.

Figure 7. Activity in oil-importing economies

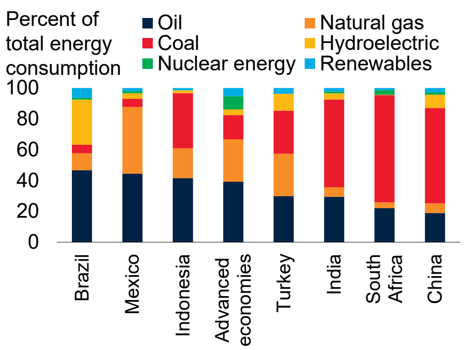
A. Share of advanced economies with increasing/decreasing growth



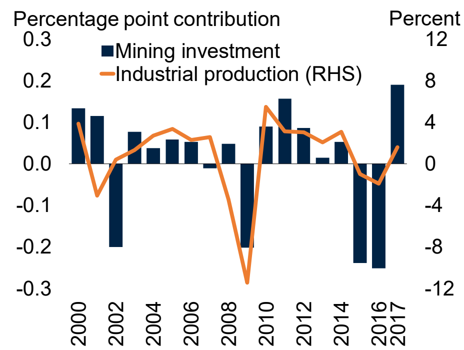
B. Share of oil-importing EMDEs with increasing/decreasing growth



C. Consumption by fuel type, 2016



D. Contribution of mining investment to U.S. GDP growth and U.S. industrial production growth



Sources: BP Statistical Review, Federal Reserve Bank of St. Louis, World Bank.

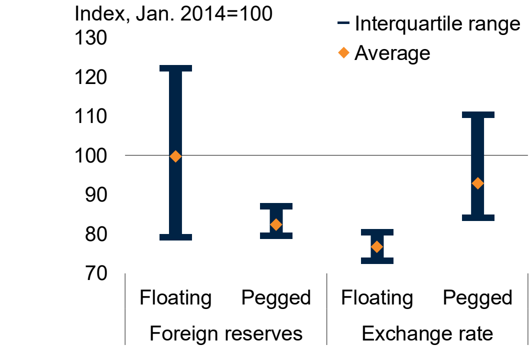
A. B. Aggregate growth rates calculated using constant 2010 U.S. dollar GDP weights. Increasing/decreasing growth are changes of at least 0.1 percentage point from the previous year. Countries with a slower pace of contraction from one year to the next are included in the increasing growth category.

C. Oil consumption is measured in million tonnes; other fuels in million tonnes of oil equivalent. Renewables are based on gross generation from renewable sources including wind, geothermal, solar, biomass, and waste, but not accounting for cross-border electricity supply.

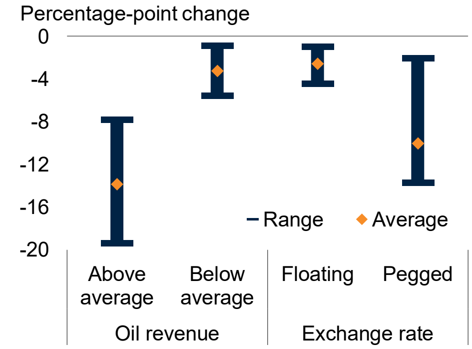
D. Mining investment is real private fixed investment of nonresidential structures for mining exploration, shafts, and wells.

Figure 8. Policy response in oil-exporting EMDEs

A. Exchange rate pressures



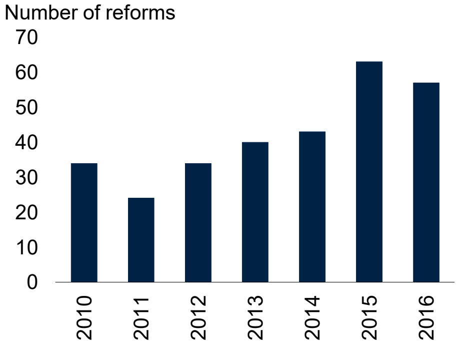
B. Change in fiscal balance since 2014



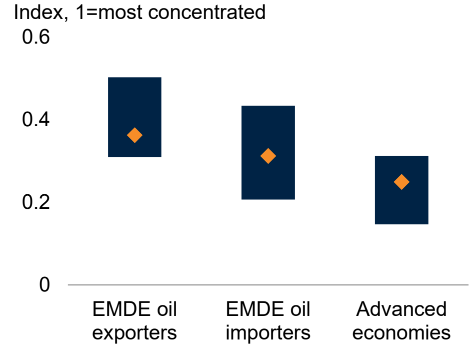
Sources: Bank for International Settlements, Haver Analytics, International Monetary Fund, World Bank.
A. B. Exchange rate classification is based on the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions database, in which countries are ranked 0 (no separate legal tender) to 10 (free float). "Pegged" denotes countries ranked 1 to 6. "Floating" denotes countries ranked 7 to 10.
A. Nominal effective exchange rate and foreign reserved indexed to 100=January 2014. Last observation is March 2018.
B. Change in overall fiscal balance as a percent of GDP from 2014 to 2016.

Figure 9. Reforms in Oil Exporters and Export Concentration

A. Number of reforms implemented in oil-exporting EMDEs



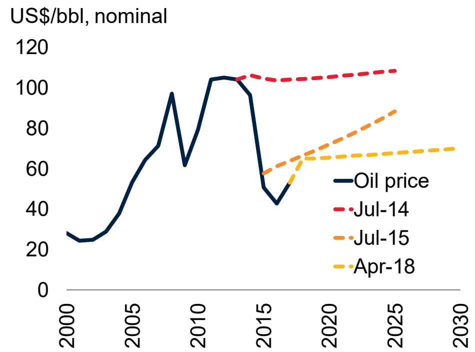
B. Export concentration, 2016



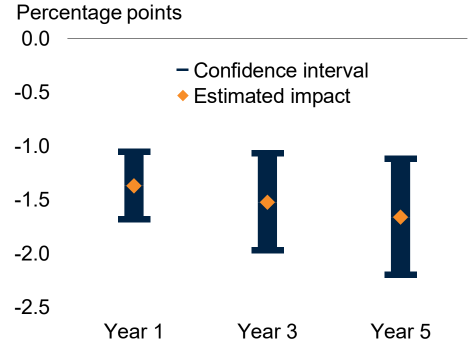
Sources: United Nations Conference on Trade and Development (UNCTAD), World Bank Doing Business.
A. Number of reforms reported in Doing Business in the following areas: making it easier to start a business, making it easier to deal with construction permits, making it easier to get electricity, making it easier to register property, making it easier to get credit, making it easier to protect minority investors, making it easier to pay taxes, making it easier to trade across borders, making it easier to enforce contracts, and making it easier to resolve insolvency. Sample includes 35 oil-exporting EMDEs.
B. Orange diamonds denote the median and blue bars represent the interquartile range of individual country groups. Sample includes 34 oil-exporting EMDEs (excludes South Sudan), 116 oil-importing EMDEs, and 36 advanced economies. Concentration index measures the degree of product concentration, where values closer to 1 indicate that a country's exports are highly concentrated on a few products.

Figure 10. Long-term outlook

A. Oil price forecasts, over time



B. Potential growth response to contraction events in oil-exporting EMDEs



Source: World Bank.
A. Forecasts from various editions of World Bank's "Commodity Markets Outlook" report.
B. Contractions are defined as the years of negative output growth from the year after the output peak to output trough. Sample includes 9 oil-exporting EMDEs. Dependent variable defined as cumulative slowdown in potential growth after a contraction event. Bars show coefficient estimates, while vertical lines show shock +/- 1.64 standard deviations (10 percent confidence bands). The methodology is described in Chapter 3 of World Bank (2018a).

Appendix 1. Country classification

EMDE oil exporters[1]

Albania
Algeria
Angola
Azerbaijan
Bahrain
Bolivia*
Brunei Darussalam
Cameroon
Chad
Colombia
Congo, Rep.
Ecuador
Equatorial Guinea
Gabon
Ghana
Iran, Islamic Rep.
Iraq
Kazakhstan
Kuwait
Libya
Malaysia*
Myanmar*
Nigeria
Oman
Qatar*
Russia
Saudi Arabia
South Sudan
Sudan
Timor-Leste
Trinidad and Tobago
Turkmenistan*
United Arab Emirates
Venezuela, RB
Yemen, Rep.*

EMDE non-oil commodity exporters[2]

Argentina
Armenia
Belize
Benin
Botswana
Brazil
Burkina Faso
Burundi
Central African Republic
Chile
Congo, Dem. Rep.
Costa Rica
Côte d'Ivoire
Ethiopia
Gambia, The
Guatemala
Guinea
Guinea-Bissau
Guyana
Honduras
Indonesia
Kenya
Kosovo
Kyrgyz Republic
Lao PDR
Liberia
Madagascar
Malawi
Mali
Mauritania
Mongolia
Morocco
Mozambique
Namibia
Nicaragua
Niger
Papua New Guinea
Paraguay
Peru
Rwanda
São Tomé and Príncipe
Senegal
Sierra Leone
South Africa
Suriname
Tajikistan
Tanzania
Togo
Tonga
Uganda
Ukraine
Uruguay
Uzbekistan
West Bank and Gaza
Zambia
Zimbabwe

EMDE commodity importers[3]

Afghanistan
Antigua and Barbuda
Bahamas, The
Bangladesh
Barbados
Belarus
Bhutan
Bosnia and Herzegovina
Bulgaria
Cambodia
Cabo Verde
China
Comoros
Croatia
Djibouti
Dominica
Dominican Republic
Egypt, Arab Rep.
El Salvador
Eritrea
Fiji
Georgia
Grenada
Haiti
Hungary
India
Jamaica
Jordan
Kiribati
Lebanon
Lesotho
Macedonia, FYR
Maldives
Marshall Islands
Mauritius
Mexico
Micronesia, Fed. Sts.
Moldova
Montenegro
Nauru
Nepal
Pakistan
Palau
Panama
Philippines
Poland
Romania
Serbia
Seychelles
Solomon Islands
Somalia
Sri Lanka
St. Kitts and Nevis
St. Lucia
St. Vincent and the Grenadines
Swaziland
Syrian Arab Republic
Thailand
Tunisia
Turkey
Tuvalu
Vanuatu
Vietnam

* Primarily a natural gas exporter.
1 A country is classified as oil exporter when, on average in 2012–14, exports of crude oil and natural gas accounted for 20 percent or more of total exports. Countries for which this threshold is met as a result of re-exports are excluded. Countries that are primarily exporters of natural gas are included in this category, as the price of natural gas is tightly connected to crude oil. When data are not available, judgment is used.
2 A country is classified as non-oil commodity exporter when, on average in 2012–14, either (i) total commodities exports accounted for 30 percent or more of total exports; or (ii) exports of any single commodity other than oil and gas accounted for 20 percent or more of total exports. Countries for which these thresholds are met as a result of re-exports are excluded. When data are not available, judgment is used. This taxonomy results in the classification of some well-diversified economies as importers, even if they are exporters of certain commodities.
3 Commodity importers are EMDE economies that are not classified as commodity exporters.

Appendix 2. Decomposition of supply and demand shocks to oil prices: A Bayesian structural vector autoregressive model approach

Oil supply and demand shocks are not observable and must be inferred from complex interactions between oil price fluctuations and changes in selected demand and supply indicators. Such statistical inference relies on a set of structural identification restrictions. This appendix elaborates on the Bayesian structural vector autoregressive (SVAR) approach used to distinguish supply and demand shocks and assess their respective roles in the 2014–16 oil price plunge.

The use of structural VAR models to identify shifts in oil supply and demand curves was first introduced by Kilian (2009) and later extended by Kilian and Murphy (2012) and Baumeister and Peersman (2013). Their identification strategy was based on the notion that a favorable supply shock should lead to a combination of rising oil production, higher economic activity, and lower oil prices. In contrast, a favorable demand shock should lead to an increase in economic activity and oil production, in addition to higher oil prices. In this context, shocks are identified based on sign restrictions, occasionally complemented by an assumption that the oil supply response to short-term price movements is close to zero (Kilian and Murphy 2012). Further research by Baumeister and Hamilton (2015) demonstrated that some of these identification strategies can lead to implausible estimates of oil demand and supply elasticities. Following Caldara, Cavallo, and Iacoviello (2016), a more flexible approach was selected, which complements sign restrictions on the short-term supply and demand elasticities with prior ranges based on a survey of the literature.

The specification of the model is as follows:

$$AY_t = B(L)Y_{t-1} + \varepsilon_t \qquad (1)$$

$Y_t = [q_t p_t^o y_t p_m^t]'$ denotes the vector of four endogenous variables (in first difference of log) and includes global oil production (q_t), international oil prices (p_t^o), global industrial production (y_t), and metals prices (p_m^t); A and B (L) are coefficients matrices capturing instantaneous and dynamic relationships of the system; and ε_t is a vector of error terms. The first and second equations of the system capture oil supply and demand conditions, while the third and fourth equations capture global demand conditions proxied by global industrial production and metals prices. The identification strategy consists of imposing prior distributions that map the parameters space of the matrix A to their respective empirical ranges, as follows:

$$A = \begin{bmatrix} 1 & -\alpha_s & 0 & 0 \\ 1 & -\beta_d & -\beta_y & 0 \\ -\gamma_s & 0 & 1 & 0 \\ -\delta_s & \delta_d & -\delta_y & 1 \end{bmatrix}$$

The parameters $a_s \geq 0$ and $\beta_d \leq 0$ capture short-term supply and demand elasticities of oil, respectively. The elasticity of oil price with respect to economic activity is captured by $\beta_y \geq 0$. Only changes in oil quantity directly affect manufacturing production through the parameter $\beta_s \geq 0$, while changes in oil prices have an indirect effect via their impact on oil quantity. The metals price index (p_m^t) is a leading indicator, capturing global economic activity not accounted for by industrial production (Kilian and Zhou 2017; Baumeister and Kilian 2016; Alquist and Coibion 2014; Delle Chiaie, Ferrara, and Giannone 2016). It is assumed that both oil prices and quantities affect metals prices through the parameters δ_s and δ_d . Industrial production is positively correlated with metals prices ($\delta_y \geq 0$). In the estimation, the prior distributions of a_s and β_d are restricted to be centered at median values of 0.1 and -0.1. These values were taken from a literature survey of 32 studies (Appendix Table 2.1). The model was estimated using monthly data over the period 1991–2017.

While the identification strategy is more flexible and offers more plausible estimates of short-term oil supply and demand elasticities, results tend to confirm the conclusions of earlier studies—namely, that an oil price decline driven by a favorable supply shock can be expected to support global industrial production over time, while a price decline resulting from a drop in demand is associated with a subsequent slowdown in global activity. On average, since the early 1990s, oil-specific supply and demand shocks have almost equally explained the forecast error variance of oil prices (Appendix Table 2.2). During the 2000s, the model suggests that demand shocks played a major role in driving oil price fluctuations, in line with other findings (Baumeister and Peersman 2013; Kilian and Hicks 2013). However, the relative importance of supply factors was substantially higher during the 2014–16 oil price plunge.

Appendix Table 2.1. Short-term oil demand and supply elasticities: descriptive statistics of survey of the literature

	Demand elasticity	Supply elasticity
Minimum	-0.92	-0.16
Maximum	-0.03	0.27
Median	-0.14	0.13
Mean	-0.21	0.11

Note: Statistics in the table are based on 32 studies that estimates oil supply and demand elasticities (Caldara, Cavallo, and Iacoviello 2016).

Appendix Table 2.2. Oil price forecast error variance decomposition at selected horizons over the period 1991–2017

Percent	Oil supply shock	Oil demand shock
After 6 months	39	40
After 12 months	38	39

Note: results are based on a Bayesian SVAR including (in log difference) global oil production, oil price, global industrial production and metal price. Numbers in the table are posterior median variance decomposition at the indicated horizons.

References

Aastveit, K. A., H. C. Bjørnland, and L. A. Thorsrud. 2014. "What Drives Oil Prices? Emerging versus Developed Economies." *Journal of Applied Econometrics* 30 (7): 1013–1028.

Alberola-Ila, E., J. Aizenman, R. Moreno, and F. Zampolli. 2017. "The Commodity Cycle: Macroeconomic and Financial Stability Implications – An Introduction." *Journal of International Money and Finance*, April 2017. Alquist, R., and O. Coibion. 2014. "Commodity-Price Comovement and Global Economic Activity." NBER Working Paper No. 200003, National Bureau of Economic Research, Cambridge, MA.

Arezki, R., and O. Blanchard. 2015. "The 2014 Oil Price Slump: Seven Key Questions." VoxEU.org, January 13. http://voxeu.org/article/2014-oil-price-slump-seven-key-questions.

Arezki, R., Z. Jakab, D. Laxton, A. Matsumoto, A. Nurbekyan, H. Wang, and J. Yao. 2017. "Oil Prices and the Global Economy." IMF Working Paper 17/15, International Monetary Fund, Washington, DC.

Arteta, C., M. A. Kose, M. Stocker, and T. Taskin. 2016. "Negative Interest Rate Policies: Sources and Implications." CEPR Discussion Paper 11433, Centre for Economic Policy Research, London.

Arze del Granado, F. J., D. Coady, and R. Gillingham. 2012. "The Unequal Benefits of Fuel Subsidies: A Review of Evidence for Developing Countries." *World Development* 40: 2234–2248.

Asamoah, A., E. Hanedar, and B. Shang. 2017. "Energy Subsidy Reform: Difficult yet Progressing." VoxEU.org, June 12. http://voxeu.org/article/energy-subsidy-reform-difficult-yet-progressing.

Aslam, A., S. Beidas-Strom, R. Bems, O. Celasun, S. K. Celik, and Z. Koczan. 2016. "Trading on Their Terms? Commodity Exporters in the Aftermath of the Commodity Boom." IMF Working Paper 16/27, International Monetary Fund, Washington, DC.

Baffes, J., M. A. Kose, F. L. Ohnsorge, and M. Stocker. 2015. "The Great Plunge in Oil Prices: Causes, Consequences, and Policy Responses." Policy Research Note 1, World Bank, Washington, DC.

Baffes, J., and V. Kshirsagar. 2015. "Sources of Volatility during Four Oil Price Crashes." *Applied Economics Letters* 23 (6): 402–406.

Baumeister, C., and G. Peersman. 2013. "Time-Varying Effects of Oil Supply Shocks on the U.S. Economy." *American Economic Journal: Macroeconomics* 5 (4): 1–28.

Baumeister, C., and J. D. Hamilton. 2015. "Structural Interpretation of Vector Autoregressions with Incomplete Identification: Revisiting the Role of Oil Supply and Demand Shocks." Working Paper, University of California at San Diego.

Baumeister, C., and L. Kilian. 2016. "Understanding the Decline in the Price of Oil since June 2014." *Journal of the Association of Environmental and Resource Economists* 3 (1): 131–158.

Beck, T. 2018. "Finance and Resource Booms: A Complicated Relationship. Two Proposals." In *Rethinking the Macroeconomics of Resource-Rich Countries*. VoxEU.org ebook, CEPR's Policy Portal, April 24, edited by Arezki, A, R. Boucekkine, J. Frankel, M. Laksaci, and R. van der Ploeg, https://voxeu.org/system/files/epublication/Resource_Rich_Countries_eBook.pdf.

Behar, A., and R. Ritz. 2016. "An Analysis of OPEC's Strategic Actions, U.S. Shale Growth and the 2014 Oil Price Crash." IMF Working Paper 16/131, International Monetary Fund, Washington, DC.

Beylis, G., and B. Cunha. 2017. *Energy Pricing Policies for Inclusive Growth in Latin America and the Caribbean*. Washington, DC: World Bank.

BIS (Bank for International Settlements). 2016. "Uneasy Calm Gives Way to Turbulence." *BIS Quarterly Review* (March): 1–14.

Bjørnland, H. C., F. M. Nordvik, and M. Rohrer. 2017. "Supply Flexibility in the Shale Patch: Evidence from North Dakota." CAMP Working Paper Series 2/2017, Centre for Applied Macro- and Petroleum Economics, BI Norwegian Business School, Oslo.

Bova, E., M. Ruiz-Arranz, F. G. Toscani, and H. E. Ture. 2016. "The Fiscal Costs of Contingent Liabilities: A New Dataset." IMF Working Paper 16/14, International Monetary Fund, Washington, DC.

BP. 2017. *BP Statistical Review of World Energy 2017*. London: British Petroleum Company.

Caldara, D., M. Cavallo, and M. Iacoviello. 2016. "Oil Price Elasticities and Oil Price Fluctuations." International Finance Discussion Paper 1173, Board of Governors of the Federal Reserve System, Washington, DC.

Callen, T., R. Cherif, F. Hasanov, A. Hegazy, and P. Khandelwal. 2014. "Economic Diversification in the GCC: Past, Present, and Future." IMF Staff Discussion Note 14/12, International Monetary Fund, Washington, DC.

Cherif, R., F. Hasanov, and A. Pande. 2017. "Riding the Energy Transition: Oil Beyond 2040." IMF Working Paper 17/120, International Monetary Fund, Washington, DC.

Clements, B., D. Coady, S. Fabrizio, S. Gupta, T. Alleyne, and C. Sdralevich. 2013. *Energy Subsidy Reform: Lessons and Implications.* Washington, DC: International Monetary Fund.

Coady, D., I. Parry, L. Sears, and B. Shang. 2017. "How Large Are Global Fossil Fuel Subsidies?" *World Development* 91: 11–27.

Curtis, T. 2015. "U.S. Shale Oil Dynamics in a Low Price Environment." Oxford Institute of Energy Studies, Oxford, United Kingdom.

——. 2016. "Unravelling the U.S. Shale Productivity Gains." Oxford Institute for Energy Studies, Oxford, United Kingdom.

Danforth, J., P. A. Medas, and V. Salins. 2016. *How to Adjust to a Large Fall in Commodity Prices*. Washington, DC: International Monetary Fund.

Delle Chiaie, S., Ferrara, L., and D. Giannone. 2016. "Common Factors in Commodity Prices," Manuscript, Federal Reserve Bank of New York, New York.

EIA (U.S Energy Information Administration). 2015. "World Shale Resource Assessments." September 24. U.S. Energy Information Administration, Washington, DC.

Feng, K., S. J. Davis, L. Sun, and K. Hubacek. 2015. "Drivers of CO_2 Emissions 1997-2013." *Nature Communications* 6 (7714): 1–8.

Frankel, J. 2018. "Monetary Regimes to Cope with Volatile Commodity Export Prices: Two Proposals." In *Rethinking the Macroeconomics of Resource-Rich Countries*. VoxEU.org ebook, CEPR's Policy Portal, April 24, edited by Arezki, A, R. Boucekkine, J. Frankel, M. Laksaci, and R. van der Ploeg,
https://voxeu.org/system/files/epublication/Resource_Rich_Countries_eBook.pdf.

Frankel, J. A. 2017. "How to Cope with Volatile Commodity Export Prices: Four Proposals." Working Papers 335, Center for International Development at Harvard University, Cambridge, MA.

Grigoli, F., A. Herman, and A. Swiston. 2017. "A Crude Shock: Explaining the Impact of the 2014-16 Oil Price Decline Across Exporters." IMF Working Paper 17/160, International Monetary Fund, Washington, DC.

Gylfason, T. 2018. "From Economic Diversification to Growth. Two Proposals." In *Rethinking the Macroeconomics of Resource-Rich Countries*. VoxEU.org ebook, CEPR's Policy Portal, April 24, edited by Arezki, A, R. Boucekkine, J. Frankel, M. Laksaci, and R. van der Ploeg, https://voxeu.org/system/files/epublication/Resource_Rich_Countries_eBook.pdf.

Hamilton, J. D. 2009. "Causes and Consequences of the Oil Shock of 2007-08." Brookings Papers on Economic Activity, Economic Studies Program, The Brookings Institution, vol. 40, pages 215–283.

———. 2011. "Nonlinearities and the Macroeconomic Effects of Oil Prices." *Macroeconomic Dynamics* 15(S3): 364–378.

Hesse, H. 2008. "Export Diversification and Economic Growth." Working Paper 21, Commission on Growth and Development, World Bank, Washington, DC.

Huidrom, R., M. A. Kose, and F. L. Ohnsorge. 2017. "How Important are Spillovers from Major Emerging Markets?" Discussion Paper No. 12022, Center for Economic and Policy Research, Washington, DC.

Husain, A. M., R. Arezki, P. Breuer, V. Haksar, T. Helbling, P. Medas, and M. Sommer. 2015. "Global Implications of Lower Oil Prices." IMF Staff Discussion Notes No. 15, International Monetary Fund, Washington, DC.

Ianchovichina, E., and H. Onder. 2017. "Dutch Disease: An Economic Illness Easy to Catch, Difficult to Cure." Future Developments, The Brookings Institution, Washington, DC.

IEA (International Energy Agency). 2015. *World Energy Outlook 2015*. Paris: International Energy Agency.

———. 2016. *World Energy Outlook 2016*. Paris: International Energy Agency.

———. 2017. *World Energy Outlook 2017*. Paris: International Energy Agency.

———. 2018. *World Energy Outlook 2018*. Paris: International Energy Agency.

IMF (International Monetary Fund). 2014. *2014 Spillover Report*. Washington, DC: International Monetary Fund.

———. 2016. "Economic Diversification in Oil-Exporting Arab Countries." Annual Meeting of Arab Ministers of Finance.

———. 2017a. *Fiscal Monitor: Achieving More with Less*. Washington, DC: International Monetary Fund.

———. 2017b. "If Not Now, When? Energy Price Reform in Arab Countries." Note Prepared for Annual Meeting of Arab Ministers of Finance, International Monetary Fund, Washington, DC.

Jacks, D. S., and M. Stürmer. 2016. "What Drives Commodity Price Booms and Busts?" Research Department Working Paper No. 1614, Federal Reserve Bank of Dallas, Dallas, TX.

Jo, S. 2014. "The Effects of Oil Price Uncertainty on Global Real Economic Activity." *Journal of Money, Credit and Banking* 46: 1113–1135.

Kang, J., and W. Liao. 2016. "Chinese Imports: What's Behind the Slowdown?" IMF Working Paper 16/106, International Monetary Fund, Washington, DC.

Kilian, L. 2009. "Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market." *American Economic Review* 99 (3): 1053–69.

Kilian, L., and B. Hicks. 2013. "Did Unexpectedly Strong Economic Growth Cause the Oil Price Shock of 2003–2008?" *Journal of Forecasting* 32 (5): 385–94.

Kilian, L., and D. P. Murphy. 2012. "Why Agnostic Sign Restrictions Are Not Enough: Understanding the Dynamics of Oil Market VAR Models." *Journal of the European Economic Association* 10 (5): 1166–188.

Kilian, L., and X. Zhou. 2017. "Modeling Fluctuations in the Global Demand for Commodities." CEPR Discussion Paper DP12357, Centre for Economic and Policy Research (CEPR), Washington, DC.

Kingdom of Saudi Arabia. 2016. "National Transformation Program 2020." Kingdom of Saudi Arabia, Riyadh.

Kojima, M. 2016. "Fossil Fuel Subsidy and Pricing Policies: Recent Developing Country Experience." Policy Research Working Paper 7531, World Bank, Washington, DC.

Kose, M. A., S. Kurlat, F. L. Ohnsorge, and N. Sugawara. 2017. "A Cross-Country Database of Fiscal Space." Policy Research Working Paper No. 8157, World Bank, Washington, DC.

Krane, J., and S. Y. Hung. 2016. "Energy Subsidy Reform in the Persian Gulf: The End of the Big Oil Giveaway." Issue Brief 04/28/16, Baker Institute for Public Policy, Rice University, Houston, TX.

Lederman, D., and W. Maloney. 2007. "Trade Structure and Growth" In *Natural Resources: Neither Curse nor Destiny,* edited by D. Lederman and W. Maloney. Washington, DC: World Bank.

Lippi, F., and A. Nobili. 2012. "Oil and the Macro-economy: A Quantitative Structural Analysis." *Journal of the European Economic Association* 10 (5): 1059–1083.

Lopez-Martin, B., J. Leal, and A. Martinez. 2016. "Commodity Price Risk Management and Fiscal Policy in a Sovereign Default Model." BIS Working Paper No. 620, Bank for International Settlements, Basel.

Ma, S.-C., Y. Fan, and L. Feng. 2017. "An Evaluation of Government Incentives for New Energy Vehicles in China Focusing on Vehicle Purchasing Restrictions." *Energy Policy* 11: 609–618.

McNally, R. 2017. *Crude Volatility: The History and the Future of Boom-Bust Oil Prices.* New York: Center on Global Energy Policy Series, Columbia University Press.

Mendes, A., and S. Pennings. 2017. "Consumption Smoothing and Shock Persistence: Optimal Simple Fiscal Rules for Commodity Exporters." Policy Research Working Paper 8035, World Bank, Washington, DC.

Newell, R., and B. Prest, 2017. "The Unconventional Oil Supply Boom: Aggregate Price Response from Microdata." NBER Working Paper No. 23973, National Bureau of Economic Research, Cambridge, MA.

Nigeria Ministry of Budget and National Planning. 2017. "Nigeria Economic Recovery and Growth Plan: 2017–20." Nigeria Ministry of Budget and National Planning, Abuja.

OECD (Organisation for Economic Co-operation and Development). 2014. *Economic Outlook: November 2014*. Paris: OECD.

Rystad Energy. 2017. Supply Data Services. Rystad Energy, Oslo.

Smith, J. L., and T. K. Lee. 2017. "The Price Elasticity of U.S. Shale Oil Reserves." U.S. Energy Information Administration, Washington, DC.

Sommer, M., G. Auclair, A. Fouejieu, I. Lukonga, S. Quayyum, A. Sadeghi, G. Shbaikat, A. Tiffin, J. Trevino, and B. Versailles. 2016. "Learning to Live with Cheaper Oil: Policy Adjustment in Oil-

Exporting Countries of the Middle East and Central Asia." Middle East and Central Asia Departmental Paper No. 16/03, International Monetary Fund, Washington, DC.

Torvik, R. 2018. "Oil Prices and Exchange Rate: Optimal Monetary Policy for Oil-Exporting Countries." In *Rethinking the Macroeconomics of Resource-Rich Countries*. VoxEU.org ebook, CEPR's Policy Portal, April 24, edited by, Arezki, A, R. Boucekkine, J. Frankel, M. Laksaci, and R. van der Ploeg,
https://voxeu.org/system/files/epublication/Resource_Rich_Countries_eBook.pdf.

Wang, Z., and A. Krupnick. 2013. "A Retrospective Review of Shale Gas Development in the United States." Resources for the Future, Washington, DC.

World Bank. 2015a. "Commodity Markets Outlook: Anatomy of the Last Four Oil Price Crashes." World Bank, Washington, DC.

———. 2015b. "MENA Quarterly Economic Review: Plunging Oil Prices." World Bank, Washington, DC.

———. 2015c. *Global Economic Prospects: Having Fiscal Space and Using It*. Washington, DC: World Bank.

———. 2015d. *Global Economic Prospects: The Global Economy in Transition*. Washington, DC: World Bank.

———. 2016a. "Commodity Markets Outlook: OPEC in Historical Context." World Bank, Washington, DC.

———. 2016b. *Global Economic Prospects: Divergences and Risks*. Washington, DC: World Bank.

———. 2016c. "MENA Quarterly Economic Review: Whither Oil Prices." World Bank, Washington, DC.

———. 2016d. *Global Economic Prospects: Spillovers amid Weak Growth*. Washington, DC: World Bank.

———. 2017a. *Global Economic Prospects: Weak Investment in Uncertain Times*. Washington, DC: World Bank.

———. 2017b. *Global Economic Prospects: A Fragile Recovery*. Washington, DC: World Bank.

———. 2017c. "Gulf Economic Monitor: Sustaining Fiscal Reforms in the Long-Term." World Bank, Washington, DC.

———. 2018a. *Global Economic Prospects: Broad-Based Upturn, but for How Long*? Washington, DC: World Bank.

———. 2018b. "Commodity Markets Outlook: Oil Exporters: Policies and Challenges." World Bank, Washington, DC.