COUNCIL *on*
FOREIGN
RELATIONS

Maurice R. Greenberg
Center for Geoeconomic Studies

DISCUSSION PAPER

Fiscal Breakeven Oil Prices: Uses, Abuses, and Opportunities for Improvement

Blake Clayton and Michael A. Levi
November 2015

The Council on Foreign Relations (CFR) is an independent, nonpartisan membership organization, think tank, and publisher dedicated to being a resource for its members, government officials, business executives, journalists, educators and students, civic and religious leaders, and other interested citizens in order to help them better understand the world and the foreign policy choices facing the United States and other countries. Founded in 1921, CFR carries out its mission by maintaining a diverse membership, with special programs to promote interest and develop expertise in the next generation of foreign policy leaders; convening meetings at its headquarters in New York and in Washington, DC, and other cities where senior government officials, members of Congress, global leaders, and prominent thinkers come together with CFR members to discuss and debate major international issues; supporting a Studies Program that fosters independent research, enabling CFR scholars to produce articles, reports, and books and hold roundtables that analyze foreign policy issues and make concrete policy recommendations; publishing *Foreign Affairs*, the preeminent journal on international affairs and U.S. foreign policy; sponsoring Independent Task Forces that produce reports with both findings and policy prescriptions on the most important foreign policy topics; and providing up-to-date information and analysis about world events and American foreign policy on its website, CFR.org.

The Council on Foreign Relations takes no institutional positions on policy issues and has no affiliation with the U.S. government. All views expressed in its publications and on its website are the sole responsibility of the author or authors.

This Discussion Paper was made possible through the generous support of the Alfred P. Sloan Foundation. The Sloan Foundation takes no positions on policy issues.

The authors thank Jennifer Harris and three anonymous reviewers for valuable comments on drafts of this paper. They thank Alexandra Mahler-Haug, Sabina Frizell, and Cole Wheeler for excellent research assistance.

For further information about CFR or this paper, please write to the Council on Foreign Relations, 58 East 68th Street, New York, NY 10065, or call Communications at 212.434.9888. Visit CFR's website, www.cfr.org.

Introduction

Before oil prices collapsed in 2014, geopolitical analysts often assumed that oil-exporting countries would quickly come under severe economic and, potentially, political stress if their "breakeven" oil prices—the minimum oil prices these countries' governments appeared to need to meet their spending commitments while balancing their budgets—were breached. At the same time, many market analysts believed that a price collapse was impossible because the governments of Saudi Arabia and other countries would cut oil production to shore up prices (and therefore their budgets and political standing) if prices threatened to fall below their countries' breakeven levels.[1]

These assumptions proved wrong. Riyadh and its peers did not trim production as expected, thus allowing prices to plummet from $106 per barrel in June 2014 to $44 per barrel in January 2015.[2] And while many oil exporters faced fiscal, stability, and other geopolitical challenges as prices fell, these difficulties were consistently less than what many analysts had anticipated, as countries' breakeven prices proved not to be critical thresholds.

Over the last decade, breakeven analysis has become an increasingly popular tool among analysts and decision-makers in the U.S. government, multilateral institutions such as the International Monetary Fund (IMF) and World Bank, and the private sector, and among researchers and writers in academia, think tanks, and the media. As oil price volatility rose and oil-exporting countries made increasingly expensive commitments to their citizens, fiscal breakeven prices seemed to provide quick and straightforward insight on a variety of fronts. Before 2005, fiscal breakeven oil prices were rarely mentioned in public debates or policy documents. Since then, fiscal breakeven prices have become frequent ingredients in forecasts of political stability in critical regions, inferences of strategically important countries' vulnerability to international pressure, forecasts of world oil prices, and advocacy efforts for fiscal reforms across the Middle East and beyond.

Used correctly, fiscal breakeven prices can provide useful insight into important geopolitical and market dynamics, and help improve policy and commercial decisions. But used improperly, they can confuse, rather than illuminate, steering policymakers and market participants into poor choices. Senior decision-makers are often unaware of the limitations of fiscal breakeven oil prices in forecasting political stability, geopolitical resilience, or oil prices. Those who do understand many of their important limitations still often remain unaware of how inaccurate, and therefore additionally misleading, breakeven price estimates can be.

There has been no systematic public attempt to assess technical limitations in how fiscal breakeven oil prices are estimated, to determine best practices, and to recommend improvements. This paper identifies common pitfalls in the application of fiscal breakeven oil prices to geopolitical and market analysis—essentially a "how not to" guide for policymakers, market participants, and those whose insights they rely on—and recommends changes to how fiscal breakeven oil prices are estimated and communicated.

Uses and Abuses of Fiscal Breakeven Oil Prices

VALUE OF FISCAL BREAKEVEN OIL PRICE ESTIMATES

Knowing an oil-exporting country's fiscal breakeven price can be useful to geopolitical and market analysts as well as to policymakers who are trying to shape oil-exporting countries' behavior.

A government that insists on balancing its budget—whether because it lacks access to funds to plug a shortfall or because it is politically committed to avoiding budget deficits—will need to raise revenues, cut spending, or do both when the oil price falls below that government's fiscal breakeven threshold. Its actions could provoke public anger, leading to social or political instability, as has often been the case when cash-strapped oil exporters have tried to balance their budgets by slashing consumer fuel subsidies. Leaders of a country facing international pressure and newly threatened with budget deficits might also, in principle, make broader geopolitical concessions in exchange for relief (for example, from economic sanctions) or reward (for example, through foreign aid) in order to ensure that their budget balances. (Iran and Russia have recently faced such circumstances, though not necessarily ones that have changed their behavior as a result.) Even when a government does not face a firm requirement that it balance its budget, a shift from surplus to deficit as oil prices fall below the country's fiscal breakeven could prompt other countries to view it as strategically weak. The country's new fiscal predicament could similarly become ammunition for any domestic opposition to its government, making political change more likely.

Fiscal breakeven oil prices can also provide insight into the pressures that might shape oil-exporting countries' decisions about how much oil to produce, and hence shed light on future global oil supplies and prices. One popular model of oil-exporter behavior imagines them as focused first on meeting their budgetary obligations. If the price of oil rises or falls without shifting a given exporter from budgetary surplus to deficit, that exporter will be content with the status quo and keep its oil production plans unchanged. This model is particularly powerful in explaining why oil prices rose steadily during the 2000s: each year, oil demand rose, driving up prices, but oil exporters that previously had budget surpluses continued to be in the black and therefore chose not to increase production; as a result, prices rose further, continuing the cycle.

This model also implies, though, that as oil prices fall below a given country's fiscal breakeven price, its production policy might change. Production could increase if leaders believe that they can sell more oil without unduly pushing world oil prices down. (For countries other than Saudi Arabia, Kuwait, and the United Arab Emirates (UAE), which hold spare production capacity that can be exploited on short notice, it would take years for new investment to spur additional production.) Production could, conversely, decrease if leaders believed that doing so could push oil prices up and restore budget balance. What matters fundamentally here is that a breach of a country's fiscal breakeven oil price could trigger reassessment of its oil production policy that might otherwise not occur.

Fiscal breakeven prices are also used as a tool in efforts to promote fiscal reform in general and fossil fuel subsidy reform in particular. In interviews, U.S. government officials and staff members at the IMF and World Bank described fiscal breakeven estimates as a valuable messaging tool that could function as a rough proxy for economic resilience, useful despite their admitted imperfections.[3] Sever-

al emphasized the role of breakevens as empowering reform-minded officials to teach their governments and citizens about subsidy reform.[4] Breakevens are seen as being relatively easy for policymakers to grasp because they link neatly to real-world oil prices and vividly convey the dangers of unsustainable spending habits and lack of economic diversification.[5] In doing so, some argue, breakevens make it easier for policymakers to pursue fiscal reform.[6]

PITFALLS TO AVOID

Each of these ways of using breakeven oil prices, though, has limits. Ignoring these limits can lead to flawed geopolitical or market analysis and, consequently, to poor policy or commercial decisions.

Geopolitics and Stability

We interviewed officials at several U.S. government departments and international institutions prior to the 2014 oil price collapse. Most expressed skepticism about using fiscal breakeven price estimates as strong indicators of fiscal, social, or political stability, or vulnerability to external pressure. Instead, fiscal breakeven prices were typically described as one piece of a broader stability assessment, an input into analyzing macroeconomic conditions (particularly in the Persian Gulf countries) rather than an end in themselves.[7] Others noted that it is critical to take into account sovereign wealth fund returns, currency reserves, and other country-specific macroeconomic factors that could amplify or mitigate the political implications of oil price changes.[8] Another U.S. official cautioned that fiscal breakeven estimates "get used in a way that focuses on [them] as a threshold—as in, the price passes a threshold and bad things are immediately going to happen," adding, "that's not very accurate … because reserves of countries can cushion short-run impacts."[9]

Yet interviewees often expressed concern that others, including government colleagues, were misusing breakeven estimates to make unjustifiably confident predictions of geopolitical developments and potential consequences of U.S. policy maneuvers.[10] National security analysts often invoke fiscal breakeven oil prices to assess countries' stability and susceptibility to geopolitical pressure. For example, writing in *Foreign Affairs*, two analysts used fiscal breakeven prices as a guide to explore the political stability of various Middle Eastern oil producers in the face of falling oil prices, associating higher breakeven prices with greater risk.[11] This perspective is echoed by similar sentiments in well-respected media. A small sample of the vast universe of articles citing fiscal breakeven prices provides a sense of how they are used: "The Saudis Need Those High Oil Prices" (*Bloomberg Businessweek*) and "Why Vladimir Putin Needs Higher Oil Prices" (*Time*).[12] Indeed, few oil-exporting countries are immune from such speculation, as another 2013 *Wall Street Journal* headline—"Break-Even Oil Price Bogeyman Stalks Gulf Economies"—made apparent.[13]

Yet the more skeptical officials are more often correct.

Many oil exporters have multiple economic levers they can pull to adjust to a prolonged low-oil price scenario. Oil-exporting countries' fiscal obligations are rarely set in stone.[14] For example, prior to the oil price crash in 2014, analysts frequently cited Riyadh's lavish social spending promises made during the Arab Spring uprisings as suggesting the country would need to cut politically sensitive spending if prices fell sharply. Yet in 2015, with oil prices having cratered, the Saudis increased debt and slashed state spending while leaving sensitive areas essentially untouched.[15] In this case, stretching out infrastructure spending over longer periods of time, reducing oil production investment, and

extracting price cuts from companies that provide Saudi Arabia with oilfield services all provided substantial buffers.

Moreover, some exporters—notably Russia, Iran, and Venezuela—have floating currencies that weaken against the dollar when oil prices drop. Oil prices can thus fall in dollars without falling (or without falling as much as might otherwise be the case) in local currency terms. This can allow governments with floating currencies to weather large oil price drops without significantly adjusting their (domestic currency denominated) budgets.[16]

This is not to say that exporters can perpetually ignore their domestic financing needs.[17] Eventually, some reconciliation must be reached between their internal fiscal needs and public revenue. This coming-to-terms can happen through painful channels (for example, hyperinflation or sovereign debt default) or less punishing means (for example, reduction of public spending, changes in the investment regime for oil production to boost output, or tax reform).[18] Many countries whose fiscal breakeven points are closely followed will labor for many years without oil prices ever rebounding to those levels and without needing to make precipitous adjustments.

Russia provides a vivid illustration of why analysts should be cautious in relying on fiscal breakeven prices. Predictions of geopolitical instability in Russia were relatively commonplace after the oil price crash that began in 2014. Analysts questioned whether Moscow would be able to fund its social spending obligations with oil prices resting below its breakeven level, typically estimated at roughly $100 per barrel by reputable analysts.[19] The logic was that a failure to fund these obligations and deliver economic growth would be a recipe for civil unrest, mounting discontent with Vladimir Putin's government, and possibly even regime change.[20]

The fiscal damage that low oil prices have caused to Russia since 2014 is real and ongoing, as the country's officials have admitted.[21] Yet Moscow's geopolitical behavior, let alone the existence of the regime, has so far proven much less susceptible to oil prices nearly 50 percent lower than what the country's budget previously appeared to demand. This is in part because these breakeven estimates were wrong (a diagnosis of why is detailed below), and also because Moscow has been able to draw on currency reserves and strong political support to continue funding government programs at a high-enough level that has not yet prompted stiff political pressure.

Oil Production Decisions and Price Forecasting

Those we interviewed were also skeptical of using fiscal breakeven price estimates as indicators of future oil prices. One IMF contact made clear that the institution would not use them to predict future oil production decisions, noting that because all Organization of the Petroleum Exporting Countries (OPEC) members except Saudi Arabia produce at or near capacity, predicting production decisions based on breakeven values would be wrongheaded.[22]

Yet many officials at systemically important institutions have used fiscal breakeven price estimates in this way. Researchers at the International Energy Agency (IEA) laid out the typical logic in 2011: "[T]o generate sufficient revenue to balance government budgets in OPEC countries (the budget breakeven) requires a much higher oil price and this figure has been rising in recent years.… This will become an increasingly important consideration in the formation of future oil prices."[23] A 2013 World Bank paper argued: "The fiscal breakeven price of oil needed to balance the budget in major oil exporters has risen sharply in recent years, making the prospect of prolonged periods of low prices unlikely in the future."[24] Private market analysts have invoked similar logic. Analysts at a major

European bank premised their 2012 price forecast on similar logic, and the prominent oil executive T. Boone Pickens cited Saudi Arabia's "need" for high prices to argue that $100 per barrel was here to stay, shortly before oil prices collapsed in late 2014.[25] Similar sentiment is common in the media. Fareed Zakaria described the logic well for CNN in 2012: "Look at the 'break-even' costs for the world's top oil producers.… [N]ow it is in these countries' interest to keep oil prices high, which they do by curtailing supply.… [T]he bottom line is an oil crash seems unlikely."[26] When a *Financial Times* columnist explained later that year that OPEC was "unlikely to disrupt [the U.S.] shale boom," the reason given was that OPEC's "capacity to push prices lower to disrupt new emerging sources of supply is constrained by members' higher fiscal break-evens".[27]

These judgments became much less frequent in late 2014 as oil prices fell well below consensus estimates of many exporters' fiscal breakeven points but did not trigger any immediate OPEC production cuts. Instead, many analysts continue to cite breakeven prices in arguing that oil prices must rise at some point in the future, though the time horizon in mind and the reason for their confidence is typically left unsaid.

In practice, breakeven prices rarely form meaningful constraints on national decisions about oil production and are typically overshadowed in decision-making by other concerns, political and economic. It might seem obvious that countries that depend on oil exports for revenues would calibrate their production to ensure that their oil-export revenues adequately cover their fiscal commitments in any given year. Yet for all but a few exporters, curtailing production, in the absence of a unified decision by other producers to do the same, would only mean the loss of market share. Export receipts would shrink as volumes declined, but global prices would stay unchanged as other countries ramped up production to fill the gap. A government running an unsustainable fiscal deficit might conclude that producing less oil would mean lower revenues, leaving the better choice to be continuing production.[28]

Given its propensity to adjust its production levels to alter global prices, Saudi Arabia is commonly viewed as the country most likely to curtail production should prices fall below its breakeven levels.[29] It is true that Riyadh plays a unique and well-recognized balancing role in the global oil market. Yet its oil output is governed by many factors, including its desire to maintain its share of the global market; optimize its position in major downstream markets in China, the United States, and elsewhere; and sustain output of natural gas that is produced alongside oil. Nor is Riyadh a simple profit maximizer; it also has pressing noneconomic concerns, such as its position relative to geopolitical rivals, chiefly Iran, that can make keeping oil prices far lower than $90 per barrel advantageous.[30] Moreover, Saudi Arabia can run deficits for protracted periods.[31] Indeed, Riyadh has been willing to ignore fiscal breakeven considerations at exactly those moments when the market is most expecting it will defend them.[32] This was the case in the 1986 oil price crash, when Saudi Arabia refusal to backstop quota-breaking by other OPEC producers and thus cede market share, precipitated a bear market in crude in which real prices did not rebound to previous highs until 2005.[33] Saudi Arabia weathered that period by running budget deficits during sixteen of the intervening years.[34]

Nor is Saudi Arabia the only producer able to essentially ignore its fiscal breakeven price in production decisions. Many countries, particularly the Gulf states, save substantially during boom times, giving themselves fiscal leeway when prices fall below their breakeven levels. The UAE, Qatar, and Kuwait announced record public budgets in early 2015, able to sustain oil prices below their fiscal breakevens for several years or longer, thanks to low debt levels and large reserves.[35] Gulf Cooperation Council (GCC) states held $881 billion in official foreign reserves in 2013, not including another $1.7

trillion in sovereign wealth funds and other state investment vehicles.[36] Such buffers allow the Saudis and their Gulf peers to look past immediate fiscal needs for several years or more.

Ultimately, utilizing breakeven analysis as a predictive tool, particularly for geopolitical analysis, is fraught. Breakeven analysis can be most useful to policymakers and analysts as a simple, if rough, measure of relative fiscal health among major oil-exporting countries. Even then, policymakers and analysts face a second problem: estimates of fiscal breakeven prices are often unreliable. Several improvements in how they are calculated, interpreted, applied, and communicated are essential.

IMF Breakeven Oil Price Estimates

IMF breakeven figures are used more frequently than any others. Policy analysts, the media, and government officials invoke them often. Assessing the IMF record, thus, provides insight into not only the reliability of this prominent set of fiscal breakeven analyses but also the broader enterprise of estimating fiscal breakeven oil prices; it points the way to valuable improvements.

The IMF began producing and publishing annual assessments of fiscal breakeven oil prices for Middle Eastern, North African, and Central Asian oil and gas exporters in October 2008 amid plunging oil prices. (Beginning in 2013, it added midyear updates.) In October or November of each year between 2008 and 2014 (excluding 2009), the IMF published fiscal breakeven oil price estimates for the current year. (In October 2008, for example, it published estimates of fiscal breakeven prices for 2008.) [37] One might expect such estimates to be easy to produce accurately since they are mostly retrospective. Yet even these figures are challenging to get right.

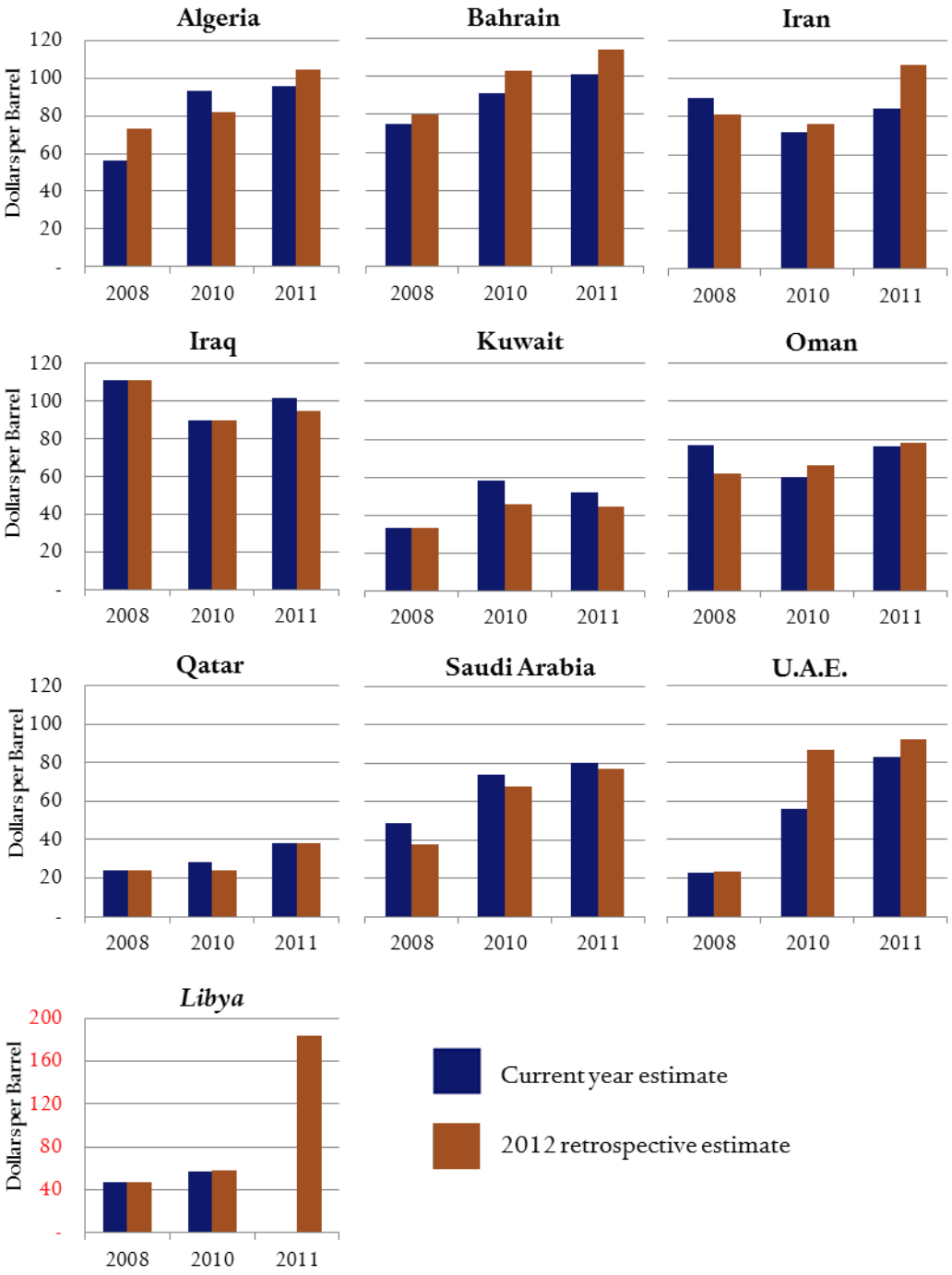
Consider the estimates for 2008, 2010, and 2011. In November 2012, the IMF published estimates of fiscal breakeven prices for each year in the period 2008–2012. Comparing these to the same-year estimates made in 2008, 2010, and 2011 sheds light on how accurate the original estimates were (figure 1). Using simple least-squares fit between the same-year estimates and retrospective ones shows that the estimates for 2008, 2010, and 2011 published in each of those years predicted 90, 83, and 88 percent of actual fiscal breakeven oil prices (as estimated after the fact) for those years.[38] Forecasts both under- and over-estimated actual fiscal breakeven oil prices.

The IMF record in calculating fiscal breakeven prices for 2013 is particularly illuminating because it includes five different estimates. The IMF issued estimates for the 2013 fiscal breakeven oil price in November 2012, May and November 2013, May and October 2014, and May 2015 (figure 2). The estimates for five countries (Iraq, Qatar, UAE, Azerbaijan, and Kazakhstan) varied by 20 percent or more over this period. The estimate for Saudi Arabia was the only one that varied by less than 10 percent over this period (excepting the estimate for Yemen, which was never updated).

Figure 3 shows how the IMF estimates converged on their ultimate values over time. The November 2012 estimates predicted, on average, 70 percent of the actual 2013 fiscal breakeven price as estimated in May 2015. That figure improved with subsequent projections. Yet even the May 2014 estimates, prepared after 2013 was already over, were revised by May 2015.

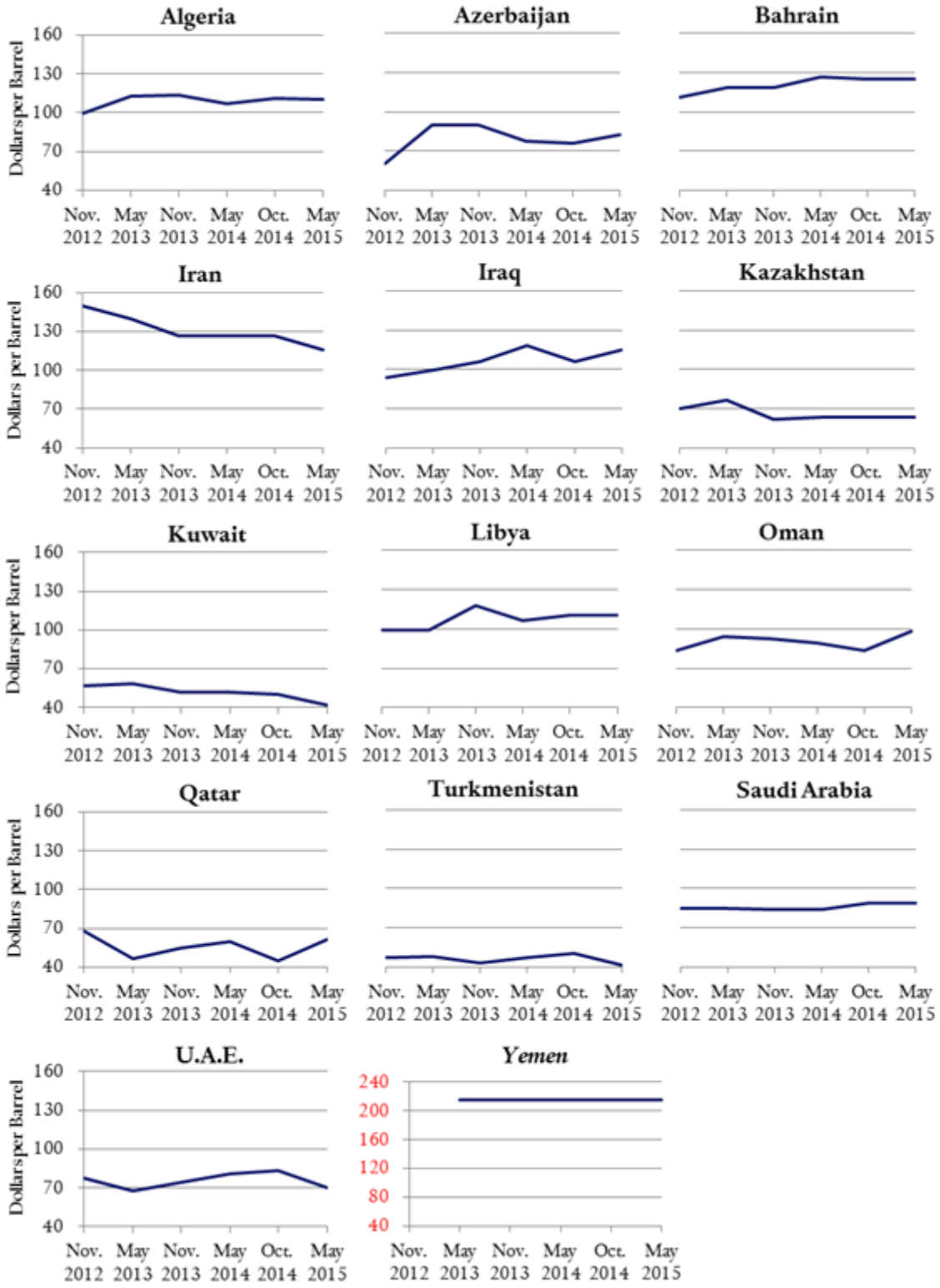
One can also extract useful lessons from IMF estimates of 2014 and 2015 fiscal breakeven oil prices. Figure 4 shows how estimated 2014 fiscal breakeven oil prices evolved between May 2013 and May 2015. Estimates for Iraq, Libya, Qatar, Kazakhstan, and Turkmenistan all varied by 20 percent or more over this period. Only Oman and Bahrain saw their estimates vary by less than 10 percent.

Figure 1. Same-Year Fiscal Breakeven Estimates Versus Retrospective Estimates



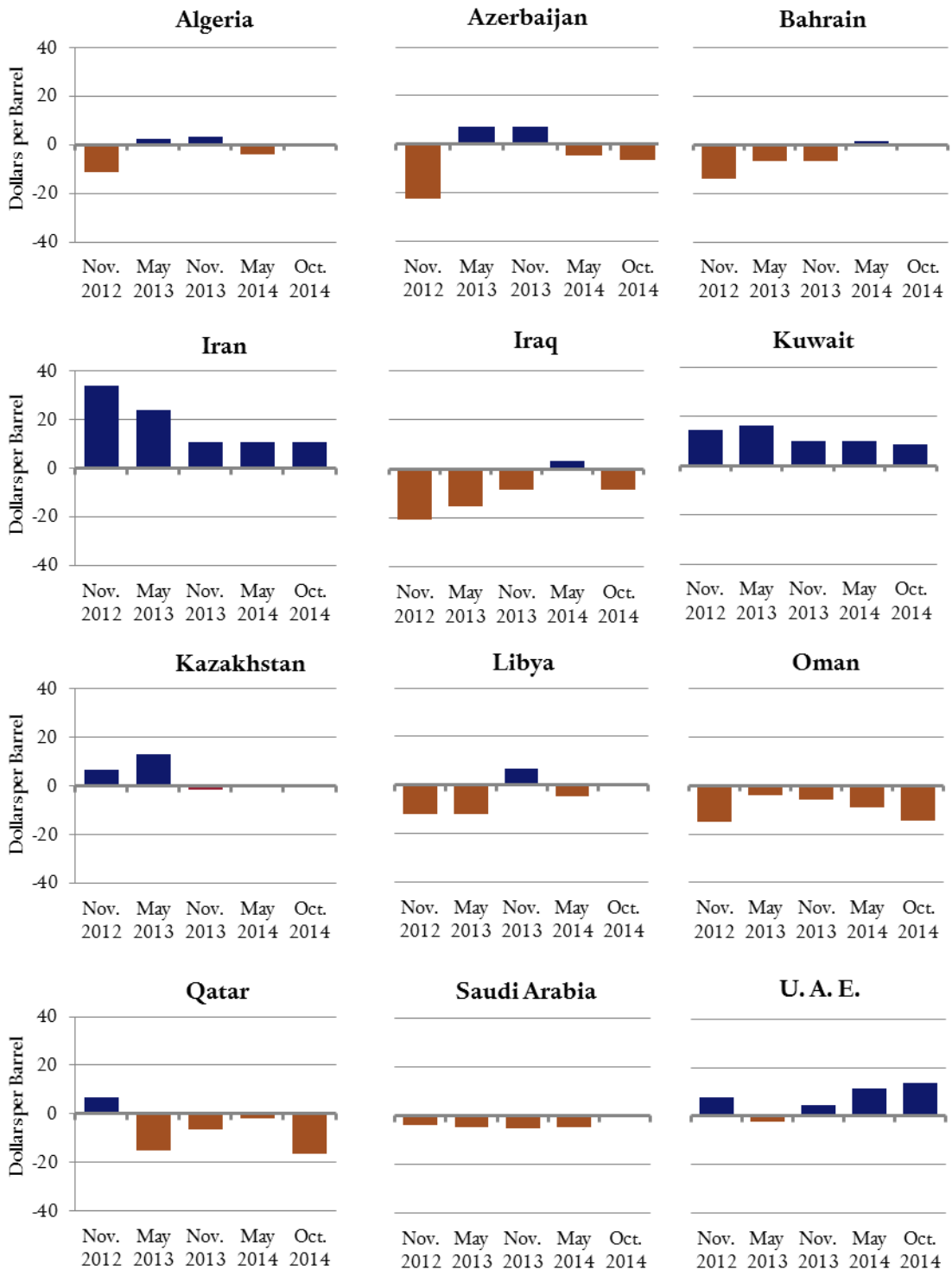
Source: IMF *Regional Economic Outlook: Middle East and Central Asia* (October 2008, October 2010, October 2011, and November 2012).

Figure 2. Change Over Time in 2013 IMF Fiscal Breakeven Estimates



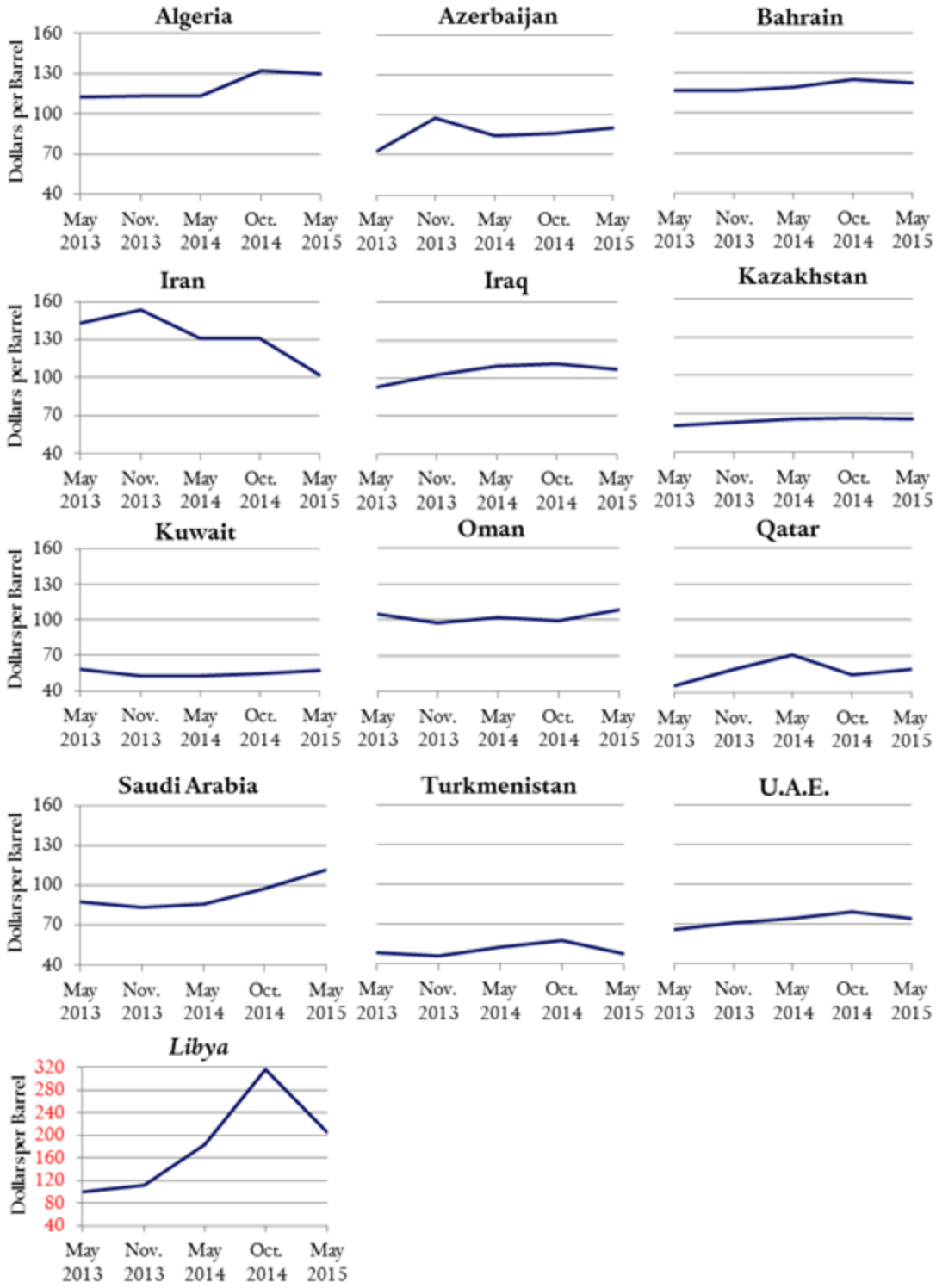
Source: IMF *Regional Economic Outlook: Middle East and Central Asia* (November 2012, May 2013, November 2013, May 2014, October 2014, and May 2015).

Figure 3. Variance of 2013 IMF Breakeven Prices From Retrospective Estimates



Source: IMF *Regional Economic Outlook: Middle East and Central Asia* (November 2012, May 2013, November 2013, May 2014, October 2014, and May 2015).

Figure 4. Change Over Time in IMF Breakeven Price Estimates for 2014

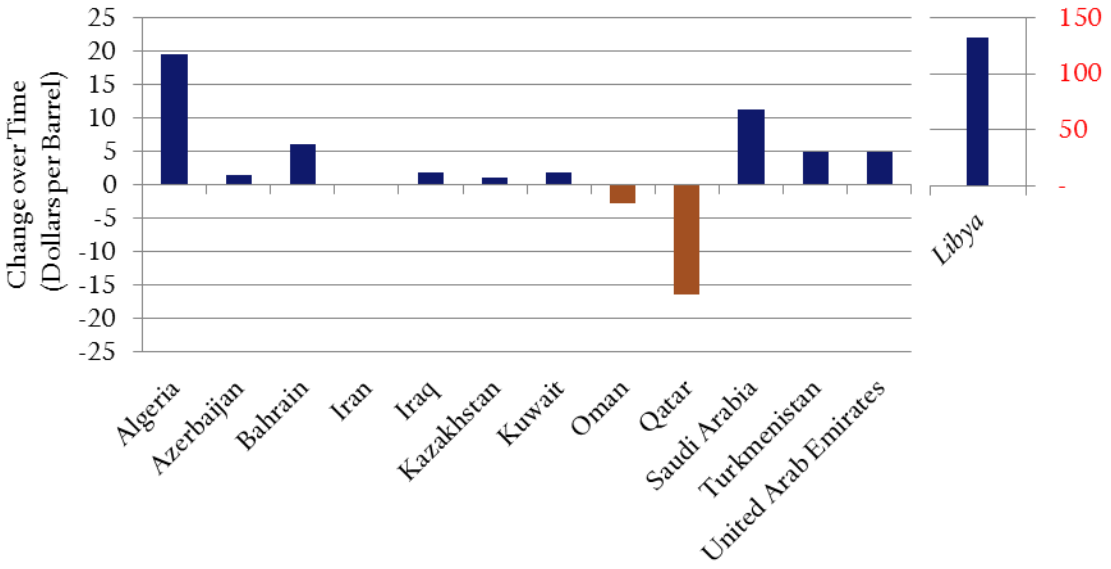


Source: IMF *Regional Economic Outlook: Middle East and Central Asia* (May 2013, November 2013, May 2014, October 2014, and May 2015).

Even between May and October 2014 (figure 5), a span of only five months, the estimated 2015 fiscal breakeven price for four of the countries covered by the IMF (Algeria, Libya, Qatar, and Saudi Arabia) changed by more than 10 percent.

There is no simple way to determine what precisely drove each observed change in estimated fiscal breakeven prices, since the estimates are typically the output of proprietary model runs rather than the product of simple formulas. (This is not a criticism of this approach: using models that capture important economic dynamics leads to better estimates, but it inevitably comes at the expense of transparency.) Broadly, though, estimates of fiscal breakeven oil prices evolved for six main reasons. Analysts outside the IMF contend with these same issues in estimating fiscal breakeven oil prices.

Figure 5. Change Between Initial and Midyear 2014 Breakeven Estimates



Source: IMF *Regional Economic Outlook: Middle East and Central Asia* (May 2014 and October 2014).

CHANGES IN EXPECTED OIL PRODUCTION AND EXPORTS

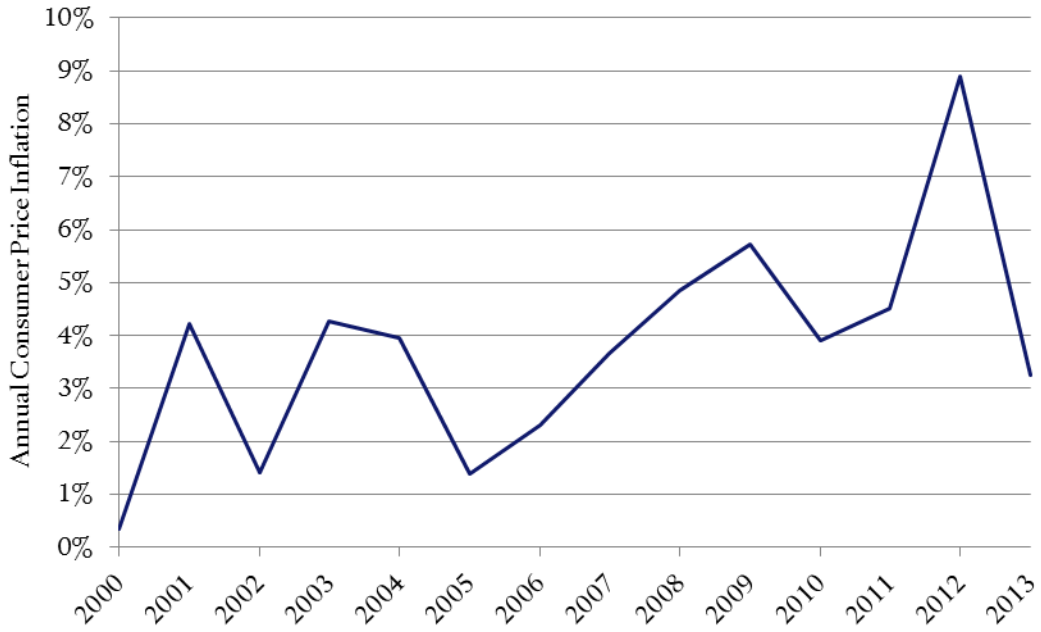
The most obvious way in which breakeven oil price estimates can be wrong is through inaccurate estimates of oil production or exports; if sales volumes are lower than anticipated, per-barrel revenue needs to be commensurately higher in order to balance an otherwise unchanged budget. Absent geopolitical disruptions, it is usually relatively straightforward to reliably estimate oil exports for the year in which the estimate is made or for the year after, a pattern confirmed by past IMF estimates. But that track record also reveals three ways in which such estimates can falter. Oil production and exports can be altered by unexpected changes in the security climate. Thus, for example, Iraq ultimately exported 15 percent less oil in 2013 than the IMF had estimated in May of that year. Oil production and exports can also change because of political decisions to curb production in order to boost market prices. For example, UAE oil exports were ultimately 7 percent lower in 2008 than the IMF had estimated in October of that year, as core OPEC members curbed production late in the year in an attempt to combat plunging prices. It is also easier to misestimate oil exports several years into the future since new production projects can be slow to come online, existing production can decline at a different rate than expected, and domestic consumption can change unpredictably.

INACCURATE PROJECTIONS OF GOVERNMENT SPENDING

Government spending is difficult to predict in the best of circumstances, as expenditures in future years can change in the face of new policies or contingencies. Inaccuracies in projected government spending yield outsized errors in estimated fiscal breakeven prices. The effect is particularly large for those oil-exporting countries that are less dependent on oil revenues, since a small deficit relative to the overall budget requires a relatively large change in oil revenues to balance the budget in this case.

Government spending of many oil-exporting countries is especially difficult to predict. Some are prone to bouts of unanticipated inflation that can drive up spending. Figure 6, for example, shows Algerian inflation in recent years, which has made government spending difficult to project. Others budget using a nonstandard fiscal year—April to March in Kuwait, for example—that can make predicting expenditures for a given calendar year (the figure that is needed to estimate a fiscal breakeven price for that year) particularly difficult.[39] Weak or opaque data collection in some countries can also make it difficult to determine government spending until well after it is incurred: IMF estimates for UAE government spending in 2010, for example, rose from $78 billion as of October 2010 to $91 billion when assessed in November 2012. This is also a reminder that government spending for a given year is often not known accurately until after that year is over.

Figure 6. Inflation in Algeria



Source: World Bank Open Data.

EXCHANGE-RATE CHANGES

Oil prices are typically quoted in U.S. dollars, but most government obligations in oil-exporting countries are in local currency. Exchange-rate changes can therefore alter the fiscal breakeven oil price for the affected country. One way to think about this is as a case of inaccurately projected gov-

ernment spending. If, for example, a government plans to spend the equivalent of $10 billion in local currency, but its currency falls in value by 50 percent, its spending will now be equivalent to only $5 billion, and its fiscal breakeven oil price will fall accordingly. For example, between November 2012 and October 2014, the IMF estimate of Iranian government spending fell from $109 billion to $57 billion. During that same period, though, the Iranian rial fell by more than 50 percent against the U.S. dollar. An increase in spending in local currency terms thus translated into a sharp drop in spending in U.S. dollar terms and consequently drove Iran's fiscal breakeven oil price down despite a decline in Iranian oil exports.

Yet this dynamic is fundamentally different from other failures to accurately predict government spending because changes in oil prices, which often draw attention to oil-exporting countries' fiscal breakeven prices, tend to strongly affect their exchange rates at the same time. (This excludes oil-exporting countries that peg their currencies to the U.S. dollar.) Falling oil prices weaken oil-exporting countries' currencies, reducing those countries' fiscal breakeven prices just when that is most valuable to those countries' governments.

To be certain, this adjustment mechanism can be costly. A falling exchange rate typically results in increased inflation, but a government that holds spending flat in local currency terms in the face of rising inflation is effectively cutting the services it provides its people. This can lead to social and political instability that may be more difficult for a government to manage than fiscal strains are. Indeed, faced with this choice, a government whose currency is falling may increase spending in local currency terms, eroding some of the fiscal benefit that the falling currency might have provided.

INACCURATE PROJECTIONS OF NON-OIL TAX REVENUES

Lower-than-expected non-oil tax revenues raise governments' needs for oil-export revenues, and hence push up the breakeven oil price. For example, between November 2012 and May 2013, the IMF estimate of Qatari non-oil revenues for 2013 rose from $34 billion to $40 billion, a shift equal to 10 percent of projected Qatari expenditures for that year. This helped drive down the IMF estimate of Qatar's 2013 fiscal breakeven oil price by more than 30 percent.

Incorrect projections of non-oil tax revenues can have sharply different consequences for the accuracy of breakeven oil price estimates depending on their causes. In particular, in highly oil-export-dependent countries, falling oil export revenues drag down broader economic activity, and hence non-oil tax revenues. But this dynamic is already reflected in the models that IMF staff use to estimate fiscal breakeven oil prices; as a result, any error in projecting non-oil tax revenues due solely to different-from-expected oil export revenues should not change the fiscal breakeven oil price. Non-oil tax revenues can, however, be misestimated for other reasons, including failure to accurately model the non-oil economy (including its relationship with oil exports) as well as unanticipated changes in tax policy. These types of errors will lead to mistakes in projected breakeven oil prices.

OTHER VOLATILE REVENUE SOURCES

Oil-exporting countries sometimes have volatile revenue streams other than oil sales and non-oil taxes. This can easily lead to incorrect estimates of fiscal breakeven oil prices. For instance, as much as 40 percent of Kuwaiti non-oil revenues in any given year come from government investments—primarily the Kuwait Investment Authority, Kuwait's sovereign wealth fund.[40] These investment re-

turns can be volatile and are unpredictable. For example, the IMF estimate for 2010 Kuwaiti non-oil revenues published in October 2010 was ultimately 25 percent below the actual figure (reported in 2012). In substantial part, as a result, the fiscal breakeven price was initially overestimated by 21 percent.

ANALYST DISCRETION

Estimated fiscal breakeven oil prices also reflect analyst discretion that can shift even without changes in underlying economic conditions. For example, between May and October 2014, the IMF adjusted its estimated 2013 fiscal breakeven price for Iraq down from $117.60 to $106.10. Yet over the same span, the IMF kept its assumptions for Iraqi gross domestic product (GDP), oil production, oil exports, non-oil revenues, and government expenditures unchanged. This strongly suggests that, rather than being driven by a change in observed conditions, analysts changed their modeling of the Iraqi budget or economy. Conversely, between May and October 2014, the IMF raised its estimate for 2014 and 2015 Iranian oil exports by 10 and 12 percent, respectively, yet it did not change its estimate of Iran's breakeven oil price for either year. This suggests that IMF analysts do not consistently incorporate all significant new information when they update their fiscal breakeven oil price estimates.

Problems in the Calculation and Discussion of Breakeven Oil Prices

This review of the IMF's experience shows that even the most capable and informed analysts face challenges estimating fiscal breakeven oil prices. Many of the difficulties they contend with, such as unpredictability of non-oil revenues, are unavoidable. But the way that analysts (not just at the IMF) produce and communicate breakeven price estimates can compound those problems and obscure them from users. A review of the research and commentary on the concept, as well as interviews with practitioners who model breakeven prices, points to four major issues.

LACK OF MODEL TRANSPARENCY

Analyses of breakeven oil prices for public discussion rarely disclose how those prices are calculated. Although formulas for calculating breakeven oil prices can occasionally be found in scholarly research that focuses specifically on the topic, the lion's share of policy-related papers and other available commentary do not offer such transparency.[41] Such formulas are often considered proprietary.[42] This opacity hinders public debates over policy, informed by breakeven analyses. It also impedes scrutiny and feedback within the analytical community that could help refine models.

The lack of disclosure also makes apples-to-apples comparisons between different studies about individual countries' breakeven prices difficult. Yet estimates across forecasters often vary significantly. In April and May 2014, for instance, public estimates of Saudi breakeven prices for 2014 ranged from $86 per barrel to $97 per barrel.[43] This reflects the fact that models differ in important ways, such as their incorporation of sovereign wealth fund returns, fiscal stabilization fund flows, and exchange-rate fluctuations.[44] Publishing the formulas underpinning breakeven estimates would let consumers accept or reject findings based on the underlying methodology. The lack of methodological transparency also hinders comparisons across countries because some institutions (notably the IMF, but possibly others) do not insist on consistent methodologies across different teams analyzing different countries.

EXCESSIVE PRECISION

Analysts invariably report fiscal breakeven estimates as single dollar figures. For instance, an October 2014 IMF report presents fiscal breakeven price estimates for 2014 from Libya at the high end of the forecast range at $316.80 per barrel to Kuwait at the low end at $54.20 per barrel.[45] The highly precise nature of these estimates misleadingly implies that they can be known with an exactness that, as the review and analysis of breakeven estimates above shows, is not the case.

NEGLECT OF SECOND-ORDER EFFECTS

Even within some large institutions, such as the IMF, different country-specific research teams have discretion in how they calculate their breakeven estimates. As of late 2014, some country teams, for example, incorporated historical trends in their calculations, while others did not. (There has been a recent effort at the IMF to ensure more consistency across countries in the method of calculating fiscal breakeven figures.)[46] Conventions undoubtedly differ even more widely across the various institutions that estimate fiscal breakeven prices.

Many of the factors that ought to be incorporated into breakeven models, such as exchange-rate fluctuations and volatile, country-specific public revenue sources, may not be present in many analysts' models. This is in one sense understandable: predicting some of the trickier variables, such as exchange rates, years into the future is impossible, so their omission is not necessarily a net loss for accuracy. Yet these factors can have large effects on government budgets and non-hydrocarbon fiscal revenues.[47]

The general lack of transparency around the ways analysts calculate breakeven prices makes it impossible to assess which factors each model incorporates and to judge whether the decisions to exclude certain factors are appropriate. One of the apparently few publicly available models, which appears in a 2013 research note by Arab Petroleum Investment Corporation (APICORP), provides a useful indicator of what analysts might learn if others were as admirably transparent in their formulas and assumptions.[48] Documentation for this model reveals a notable attempt to account for the value of financial assets invested abroad—something that should bolster its credibility. At the same time, the model omits exchange-rate effects, which lessens the reliability of its figures.

LACK OF INSIGHT INTO SOVEREIGN DEBT SUSTAINABILITY

A central drawback of breakeven analysis is that it does not shed light on how long a country could fail to balance its budget due to low oil prices and still remain able to service its debt. Breakeven analysis assumes a balanced budget and works backward to derive the oil price that yields that balance. In reality, sovereign budget deficit levels are not fixed at zero. They vary due to interest rates, growth rates, debt levels, spending commitments, and income-producing assets, such as sovereign wealth funds, among other variables. A more realistic measure of a country's macroeconomic risk position relative to its debt load would acknowledge the possibility for some countries to sustain fiscal deficits for a prolonged period of time without serious repercussions from external creditors.

Debt sustainability analysis (DSA), developed by the IMF in 2002, offers a useful complement to breakeven analysis in this respect.[49] Debt sustainability analysis gauges a "country's capacity to finance its policy objectives and service the ensuing debt without unduly large adjustments, which could otherwise compromise its stability."[50] The objective of the framework is to assess the current debt situation, including by developing a detailed profile of the debt held; identify the vulnerabilities in the debt structure or policy framework; and in cases where such difficulties have emerged or are about to, examine the impact of alternative debt-stabilizing policy paths. For oil-export-driven economies, oil prices should constitute an important variable in a country's debt sustainability profile.

In important ways, DSA offers an improvement over breakeven analysis by providing insight into the degree to which low oil prices would affect a country's ability to finance its government (and shedding light on how long the country's economy can hold up under such prices) rather than assum-

ing that the budget must or will balance, as breakeven analysis does. It allows analysts to consider the creditworthiness of countries and their ability to borrow to supplement their reserves. In a time when oil prices have likely fallen below breakeven prices, as in much of 2015, DSA is the best framework available for estimating when the economic pain from low oil prices will be too great for countries to bear, forcing them to make difficult decisions about energy subsidies, production levels, energy-sector reform, government spending, and debt service.

As part of its Article IV consultation reports, the IMF published recent DSAs for the majority of the oil-exporting countries included in its Middle East and Central Asia Regional Economic Outlook (REO) reports, though DSAs for these countries are generally less extensive than those that the IMF considers "higher scrutiny."[51] Most of these have not, however, explicitly modeled oil-price shocks.

Recommendations

Despite potential pitfalls, fiscal breakeven analysis can be a worthwhile exercise that can help illuminate a country's economic dependence on oil exports, motivate policy reforms, and allow analysts to better understand sovereign risks and decision-making contexts. Five best practices would ensure methodological soundness and maximize the usefulness of breakeven analysis.

INCREASE USE OF DEBT SUSTAINABILITY ANALYSIS

Debt sustainability analysis is a well-developed framework for gauging the difficulties an oil-exporting country may face in servicing its sovereign debt and estimating the timeline on which it may be forced to take policy action to right its economy. It complements and improves upon breakeven analysis in many respects, making it a worthwhile tool for policymakers seeking to understand their policy options in a low-oil-price environment and for others to anticipate what those policymakers might do.

Still, while DSA provides a more holistic assessment of a country's fiscal position, its product is not nearly as simple as a single breakeven figure. Experienced analysts may benefit from a closer look at DSA results, but less expert decision-makers may need guidance in interpreting them. Policymakers would be well served to look closely at IMF country reports (and the DSAs that inform them), which put breakeven analyses in a larger economic context.

INCREASE TRANSPARENCY WHERE POSSIBLE

Analysts who forecast breakeven oil prices, particularly those outside the private sector, should disclose their quantitative methodology to the extent possible. Many analysts and organizations inevitably want to keep their fiscal breakeven models proprietary. That is understandable, particularly in the private sector. Outside of the private sector, however, greater disclosure of the methods used to arrive at these estimates would improve their accuracy and enhance their credibility. Such disclosure would allow for informed comparisons of differing estimates and quicken the pace at which the best methodological practices are adopted. Where the full disclosure of models and formulas are impossible or impractical, qualitative discussion around the economic factors incorporated in the model, as well as its broader structure, would help.

EXPLAIN REVISIONS TO BREAKEVEN ESTIMATES

Institutions that issue recurring breakeven estimates have a special opportunity to increase transparency without revealing proprietary information. These institutions typically do not discuss the rationale behind changes in their estimates.[52] As a result, readers are left not knowing whether a change in a country's outlook is due to a change in its fiscal commitments, non-oil revenue projections, oil export volumes, a change in estimate methodology, or a change in some other macroeconomic fac-

tor, such as exchange-rate fluctuations. Analysts who publish recurring estimates could helpfully provide brief updates on the primary reasons for any changes in their estimates, much as ratings agencies do when changing sovereign debt ratings.

Leaving the rationale for an estimate change undisclosed risks causing two problems. It makes it more difficult for policymakers to utilize the estimate as a call for reforming a certain facet of their national economy that might be leading to economic decay, given that the reason for an increase in breakeven price—potentially a sign of economic risk—may be hard to discern. It can also make it harder to anticipate how the estimate might evolve over time, which limits the usefulness of the measure in anticipating broader future developments.

PUBLISH UNCERTAINTY BANDS AND SENSITIVITY ANALYSES

Augmenting breakeven price estimates with uncertainty bands and sensitivity analyses would increase their explanatory power and practical usefulness. The common practice of estimating breakeven prices to the dime (literally so in many cases) fails to give users a sense of the magnitude of the uncertainty around that single-point figure. A more accurate approach would be to calculate and report breakeven prices as uncertainty bands and incorporate sensitivity analyses highlighting major sources of uncertainty, where possible.[53] The trade-off with this approach is the loss of the single summary statistic, making it harder for policymakers to digest. Yet a precise but wrong figure will often be even worse than none at all.

Addressing this omission would make it easier to anticipate the likelihood that the actual figure could come in higher or lower than the estimated price. It could also inform retrospective analyses of the accuracy of breakeven estimates. Likewise, by conducting and publishing sensitivity analyses of their breakeven price estimates, researchers in international organizations and other public interest institutions would help public officials understand and address the major drivers of oil-price-specific risk to their own economies. While some policymakers may believe that high-precision estimates of fiscal breakeven prices are more persuasive as an advocacy tool, over time, false precision can put their credibility at risk as breakeven prices repeatedly prove to be wrong.

TAKE INTO ACCOUNT MAJOR NON-MACROECONOMIC AND SECOND-ORDER VARIABLES WHERE POSSIBLE

Many breakeven estimates would benefit from taking into consideration, at least as in alternative scenarios, changes in non-macroeconomic variables, such as the performance of state-owned enterprises (SOEs), as well as second-order variables such as exchange rates between the home currency and the U.S. dollar, as appropriate. Because these variables have can play a large role in determining breakeven prices, particularly in times of financial- and oil-market stress, including them can yield more robust models. For many, if not all major oil-exporting countries, returns from SOEs and sovereign wealth funds can cause public-funds flows to fluctuate materially from year to year.

Additional Recommendations for the IMF

Given their status as the most prominent recurring fiscal breakeven estimates, the IMF's regularly published figures are an important guidepost to policymakers and analysts alike regarding the fiscal condition of many of the world's major hydrocarbon producers. Three changes to the way the IMF calculates and disseminates its breakeven estimates, beyond those discussed prior, have the potential to increase their usefulness; a fourth change, to the IMF's application of debt sustainability analysis, would increase the value of that analysis as a complement to breakevens.

STANDARDIZED METHODOLOGIES ACROSS COUNTRIES

Standardizing the estimation methodologies that country-specific research teams use to determine their breakeven price estimates would enable readers to compare them on an apples-to-apples basis. As it stands, most readers of IMF research are likely unaware that the estimates for some countries may be calculated differently than for others, which raises the risk of unintended upside or downside bias to certain countries' figures. There have been recent and laudable efforts at the IMF to ensure more consistency across countries in the method of calculating fiscal breakeven figures; these efforts should be expanded.[54] Where teams desire latitude to tailor their model to the particular circumstances of the country they cover, they should make explicit the ways in which their calculations differ from those of their colleagues. This disclosure could be done by the IMF publishing a single reference document in which each country team (in addition to any other IMF analysts who publish breakeven estimates) lays out its quantitative methodology.

COLLABORATION AMONG REO AUTHORS AND ARTICLE IV COUNTRY TEAMS

The authors of the IMF's excellent biannual REO and both the Middle East, North Africa, Afghanistan, and Pakistan country team and the Caucasus and Central Asia country team—whose breakeven estimates are featured in the publication—may benefit from greater collaboration regarding these calculations. As it stands, the publication process consists of the country teams within these regions submitting the relevant economic data, including breakeven oil price estimates based on their own data and models, to the team that produces the REO. That team then bundles the estimates and publishes them.[55] Increased communication among the country teams and REO authors regarding methodological differences among the breakeven estimates could add nuance to how these figures are interpreted by authors and readers of the REO.

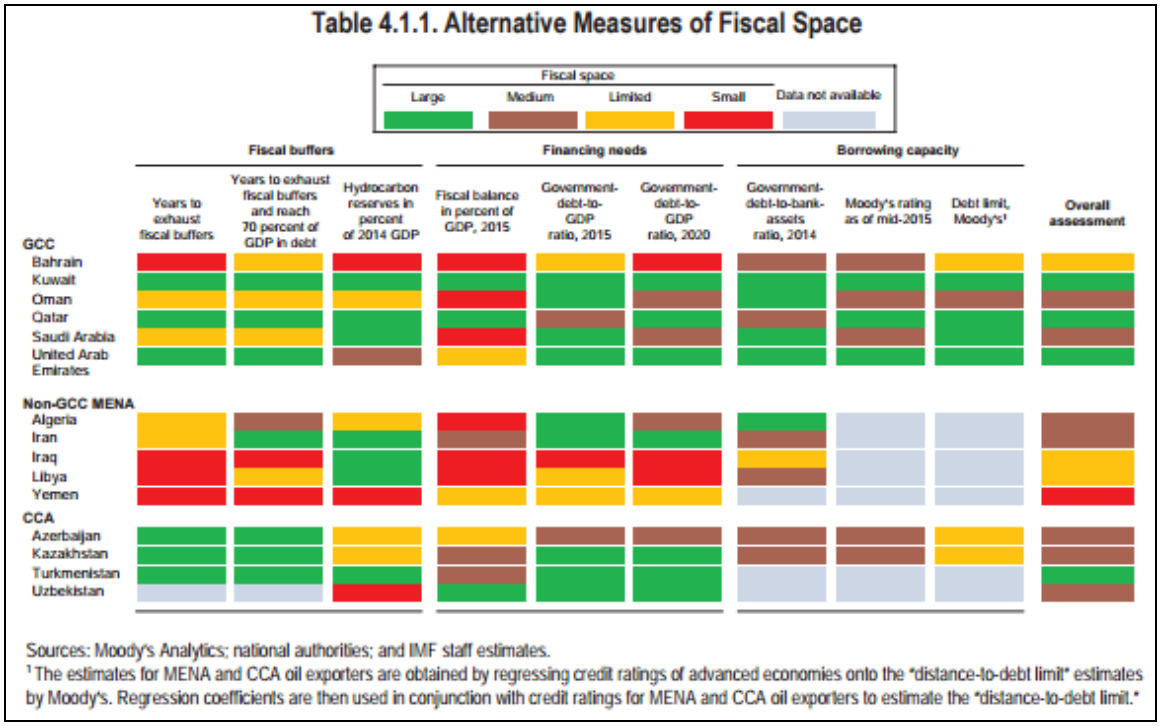
PUBLISH BREAKEVEN ANALYSES OF MAJOR OIL-EXPORTING COUNTRIES OUTSIDE MENA

The IMF should consider publishing breakeven estimates on major oil-exporting countries outside the Middle East and North Africa (MENA). Currently, it does not publish estimates beyond this region, though it may have them for internal use. Analysts outside the IMF would benefit from analysis of vital exporters like Russia and Mexico, which are deeply affected by changes in oil prices and whose energy policy and decisions can move markets.

CONDUCT "HIGHER SCRUTINY" DEBT SUSTAINABILITY ANALYSES OF OIL-EXPORTING COUNTRIES

The IMF conducts more in-depth debt sustainability analyses on countries it considers worthy of "higher scrutiny"—generally countries that have a high debt-to-GDP ratio or demonstrate other signs of fiscal vulnerability.[56] In recent years, the IMF has generally placed the oil-exporting countries discussed in this paper in the "lower scrutiny" category, resulting in DSAs that, while still useful, are less extensive in their assessment of the risks to debt sustainability. In particular, the IMF should model oil-price shocks as a regular element of DSAs of oil-exporting countries; recent DSAs have modeled oil-price shocks only for the UAE and Iraq.[57] Notably, the IMF's October 2015 Middle East and Central Asia REO contains a useful discussion of the fiscal positions and adjustment options of oil exporters in the wake of the oil price plunge. In particular, presentation of a summary table showing countries' positions along multiple dimensions (figure 7) demonstrates the possibility of communicating a more complex debt sustainability picture in a relatively accessible fashion.[58] Given the new economic climate facing oil exporters and increased international scrutiny of their economies, more frequent analysis of this sort (if perhaps not regularly as detailed, given IMF resource constraints) from the IMF would provide significant value to analysts and decision-makers.

Figure 7. IMF Table Showing Alternative Measures of Fiscal Space



Source: IMF *Regional Economic Outlook: Middle East and Central Asia* (October 2015).

Endnotes

[1] Anjli Rival, "Opec leader vows not to cut oil output even if price hits $20," *Financial Times,* December 22, 2014.

[2] "Oil: Fiscal Breakevens are a Key Guide to Exporters' Sovereign Credit Risk," Fitch Ratings, November 2014.

[3] Interview with U.S. government official, Washington, DC, July 2014; Interview with IMF contact, Washington, DC, July 2014; Interview with World Bank staff member, Washington, DC, July 2014.

[4] Interview with U.S. government official, Washington, DC, July 2014; Interview with World Bank staff member, Washington, DC, July 2014.

[5] Interview with IMF contact, Washington DC, July 2014; Interview with World Bank staff member, Washington, DC, July 2014.

[6] Ibid.

[7] Ibid.

[8] Interview with IMF official, Washington, DC, July 2014; Interview with Garbis Iradian, Deputy Director for Middle East and North Africa Department at the Institute of International Finance, Washington, DC, July 2014.

[9] Interview with U.S. Government official, Washington, DC, July 2014.

[10] Interview with IMF official, Washington, DC, July 2014.

[11] Robert D. Blackwill and Meghan L. O'Sullivan, "America's Energy Edge: The Geopolitical Consequences of the Shale Revolution," *Foreign Affairs*, March/April 2014.

[12] Glen Carey, "The Saudis Need Those High Oil Prices," *Bloomberg Business*, February 23, 2012; Michael Schuman, "Why Vladimir Putin Needs Higher Oil Prices: As Oil Prices Sink, So Do the Prospects for the Russian Economy," *Time,* July 5, 2012.

[13] Wall Street Journal Middle East Real Time, "Break-Even Oil Price Bogeyman Stalks Gulf Economies," http://blogs.wsj.com/middleeast/2013/05/28/break-even-oil-price-bogeyman-stalks-gulf-economies.

[14] Alan Gelb, Benn Eifert, Nils Borje Tallroth, "The Political Economy of Fiscal Policy and Economic Management in Oil-Exporting Countries," World Bank Policy Research Working Paper, no. 2899*,* October 2002.

[15] Simeon Kerr, "Saudi Arabia Predicted to Cut state Spending After Oil Price Fall," *Financial Times*, January 15, 2015.

[16] Ezequiel Minaya, "Venezuela Revises Foreign Exchange Rules," *Wall Street Journal,* February 10, 2015; "Russian Central Bank Seen Holding Rates as Inflation Soars: Reuters Poll," *Reuters,* March 2, 2015; "Iran's Inflation Rate Falls to 15.2 percent: Official," *Tehran Times*, February 23, 2015.

[17] See Eduardo Engel and Rodrigo Osvaldo Valdes, "Optimal Fiscal Strategy for Oil Exporting Countries," International Monetary Fund Working Paper, no. 00/118, June 2000; Paul Stevens and Matthew Hulbert, "Oil Prices: Energy Investment, Political Stability in the Exporting Countries and OPEC's Dilemma," Chatham House Programme Paper, October 2012.

[18] Benn Eifert, Alan Gelb, and Nils Borje Tallroth, "Managing Oil Wealth," *Finance and Development* 40, no. 1, International Monetary Fund, March 2003; Mohsen Mehrara and Kamran Niki Oskoui, "The Sources of Macroeconomic Fluctuations in Oil Exporting Countries: A Comparative Study," *Economic Modelling* 24, no. 3, May 2007, pp. 365–79; Engel and Valdes, "Optimal Fiscal Strategy for Oil Exporting Countries," International Monetary Fund Working Paper, no. 00/118, June 2000.

[19] Elliot Bentley, Pat Minczeski, and Jovi Juan, "Which Oil Producers Are Breaking Even?," *Wall Street Jounral,* November 27, 2014; "Economic pain, caused by Ukraine," *Economist,* September 30, 2014.

[20] Martin Feldstein, "The Geopolitical Impact of Cheap Oil," *Project Syndicate*, November 26, 2014; David M. Herszenhorn, "Fall in oil prices poses a problem for Russia, Iraq and Others," *New York Times*, October 15, 2014; Holly Ellyatt, "Russia's economic crisis will end Putin regime," CNBC News, http://www.cnbc.com/2015/03/09/russias-economic-crisis-will-end-putin-regime.html; "Speaker suggests how Russian regime change might occur," *Oil & Gas Journal*, Mar. 9, 2015.

[21] "Falling oil prices, geopolitics cost Russian budget 4% GDP – minister," Tass Russian News Agency, October 2, 2014.

[22] Interview with IMF contact, Washington, DC, July 2014.

[23] International Energy Agency, "World Energy Outlook" (Paris: International Energy Agency 2011) pp. 140.

[24] Masami Kojima, *Petroleum Product Pricing and Complementary Policies: Experience of 65 Developing Countries Since 2009* (Washington DC: World Bank, April 2013).

[25] Nic Brown, Sylvain Broyer, Abhishek Deshpande, Christian Ott, and Juan Carlos Rodado, "What Do Oil-Exporters' Budget Constraints Tell Us about the Price of Oil?," Natixis Economics Research: Flash Economics, no. 251, April 2012; CNBC, "Pickens: Brent Crude will be above $100 Forever," http://www.cnbc.com/id/101930320.

[26] Fareed Zakaria, "Zakaria: Why Oil Prices will Stay High," CNN, http://globalpublicsquare.blogs.cnn.com/2012/01/15/zakaria-why-oil-prices-will-stay-high.

[27] Javier Blas, "Opec Unlikely to Disrupt US Shale Boom," *Financial Times*, December 12, 2012.

[28] Jeff D. Colgan, "The Emperor Has No Clothes: The Limits of OPEC in the Global Oil Market," *The International Organization* 68, no. 3, June 2014, pp. 599–632; Alessandro Cologni and Matteo Manera, "On the Economic Determinants of Oil Production: Theoretical Analysis and Empirical Evidence for Small Exporting Countries," *Elsevier: Energy Economics* 44, July 2014, pp. 68–79.

[29]John Sfakianakis, "Saudi Arabia's Essential Oil: Why Riyadh Isn't Worried About the U.S. Gas Revolution," *Foreign Affairs*, January 2014.

[30] International Monetary Fund, *Regional Economic Outlook: Middle East and Central Asia* (Washington DC: International Monetary Fund, October 2014).

[31] Paul Stevens and Matthew Hulbert, "Oil Prices: Energy Investment, Political Stability in the Exporting Countries and OPEC's Dilemma," Chatham House Programme Paper, October 2012.

[32] James M. Griffin and William S. Neilson, "The 1985–1986 Oil Price Collapse and Afterwards: What Does Game Theory Add?" *Economic Inquiry* 32, no. 4, October 1994; Roberto A. De Santis, "Crude Oil Price Fluctuations and Saudi Arabia's Behavior," *Energy Economics* 25, no. 2, March 2003, pp. 155–173.

[33] Blake Clayton, *Market Madness* (New York: Oxford University Press, 2015); U.S. Energy Information Administration, "Short-Term Energy Outlook: Real Prices Viewer," http://www.eia.gov/forecasts/steo/realprices.

[34] Mohamed A. Ramady, *The Saudi Arabian Economy: Policies, Achievements, and Challenges* (Springer Science and Media, 2010), p. 50; R. M. Auty, *Resource Abundance and Economic Development* (Oxford University Press, 2001), p. 202.

[35] "Mideast Money: Austerity? Not for Us, Say Rich Gulf States as Oil Slides," *ReutersI* January 11, 2015.

[36] Martin Dokoupil, "Cheaper Oil No Big Threat to Gulf Economies, a Boon for North Africa," *Reuters,* September 18, 2014.

[37] Washington DC: International Monetary Fund, 2008–2014 editions.

[38] As measured by R-squared value.

[39] "Kuwait may cut planned spending next fiscal year—parliament," *Reuters*, December 14, 2014. Iran uses a similarly nonstandard fiscal year.

[40] Authors' calculation for year 2013 based on Kuwait News Agency, "S&P Puts Kuwait credit rating at AA/A-1," http://www.kuna.net.kw/ArticlePrintPage.aspx?id=2392252&language=en; International Monetary Fund, *Regional Economic Outlook: Middle East and Central Asia Department: Statistical Appendix* (Washington DC: International Monetary Fund, October 2010), pp. 4, 16.

[41] Literature search of publicly available sources spanning academic, think tanks, multilateral institutions, and the private sector as of winter 2014–2015.

[42] IMF contact, email correspondence, September 2015.

[43] For a sample of the extant estimates, see Abhishek Deshpande and Nic Brown, "Fiscal Break-Even Oil Prices for Major OPEC Members," *Oil & Gas Financial Journal*, April 3, 2014; International Monetary Fund, *Regional Economic Outlook Update Middle East and Central Asia Department: Statistical Appendix* (Washington DC: International Monetary Fund, May 2014).

[44] Comparison of APICROP model published in August–September 2013 and information about the IMF model provided to CFR staff.

[45] International Monetary Fund, *Regional Economic Outlook Update, Middle East and Central Asia Department: Statistical Appendix* (Washington DC: International Monetary Fund, October 2014).

[46] Interview with IMF contact, Washington, DC, July 2014.

[47] Daria Zakharova and Paulo A. Medas, "A Primer on Fiscal Analysis in Oil-Producing Countries," International Monetary Fund working papers no. 9/56, March 2009, pp. 1–39.

[48] "Modeling OPEC Fiscal Break-Even Oil Prices: New Findings and Policy Insights," *APICORP Research: Economic Commentary* 8, pp. 8–9, August–September 2013.

[49] "Debt Sustainability Analysis," International Monetary Fund, http://www.imf.org/external/pubs/ft/dsa/. Last accessed June 2015.

[50] Ibid.

[51] "Staff Guidance Note for Public Debt Sustainability Analysis in Market-Access Countries," International Monetary Fund, May 9, 2013, p. 6.

[52] Based on a review of IMF and credit rating agency publications.

[53] For a discussion of these methods, see Mårten Blix and Peter Sellin, "Uncertainty Bands for Inflation Forecasts," Sveriges Riksbank Working Paper Series, no. 67, 1998; Lutz Kilian, "Small-sample Confidence Intervals for Impulse Response Functions," *Review of Economics and Statistics* 80, no. 2, May 1998, pp. 218–230; Neil Ericsson, "Predictable Uncertainty in Economic Forecasting," in Michael P. Clements and David F. Hendry, ed., *A Companion to Economic Forecasting* (John Wiley & Sons, 2008), pp. 19–44.

[54] IMF contact, email correspondence, September 2015.

[55] Interview with IMF contact, Washington, DC, July 2014.

[56] "Staff Guidance Note for Public Debt Sustainability Analysis in Market-Access Countries," International Monetary Fund, May 9, 2013, p. 6.

[57] "Iraq: Staff Report for the 2015 Article IV Consultation and Request for Purchase Under the Rapid Financing Instrument," International Monetary Fund, July 2015, p. 60; "United Arab Emirates: Staff Report for the 2014 Article IV Consultation," August 2015, p 37.

[58] International Monetary Fund, Regional Economic Outlook Update Middle East and Central Asia Department: Statistical Appendix (Washington DC: International Monetary Fund, October 2014).

About the Authors

Blake Clayton is an adjunct fellow for energy at the Council on Foreign Relations. He is the author of *Commodity Markets and the Global Economy* and *Market Madness: A Century of Oil Panics, Crises, and Crashes*.

Michael A. Levi is the David M. Rubenstein senior fellow for energy and the environment at the Council on Foreign Relations and the director of the Maurice R. Greenberg Center for Geoeconomic Studies. He is the author of *Power Surge: Energy, Opportunity, and the Battle for America's Future* and *By All Means Necessary: How China's Resource Quest is Changing the World*.