Fattouh, Bassam

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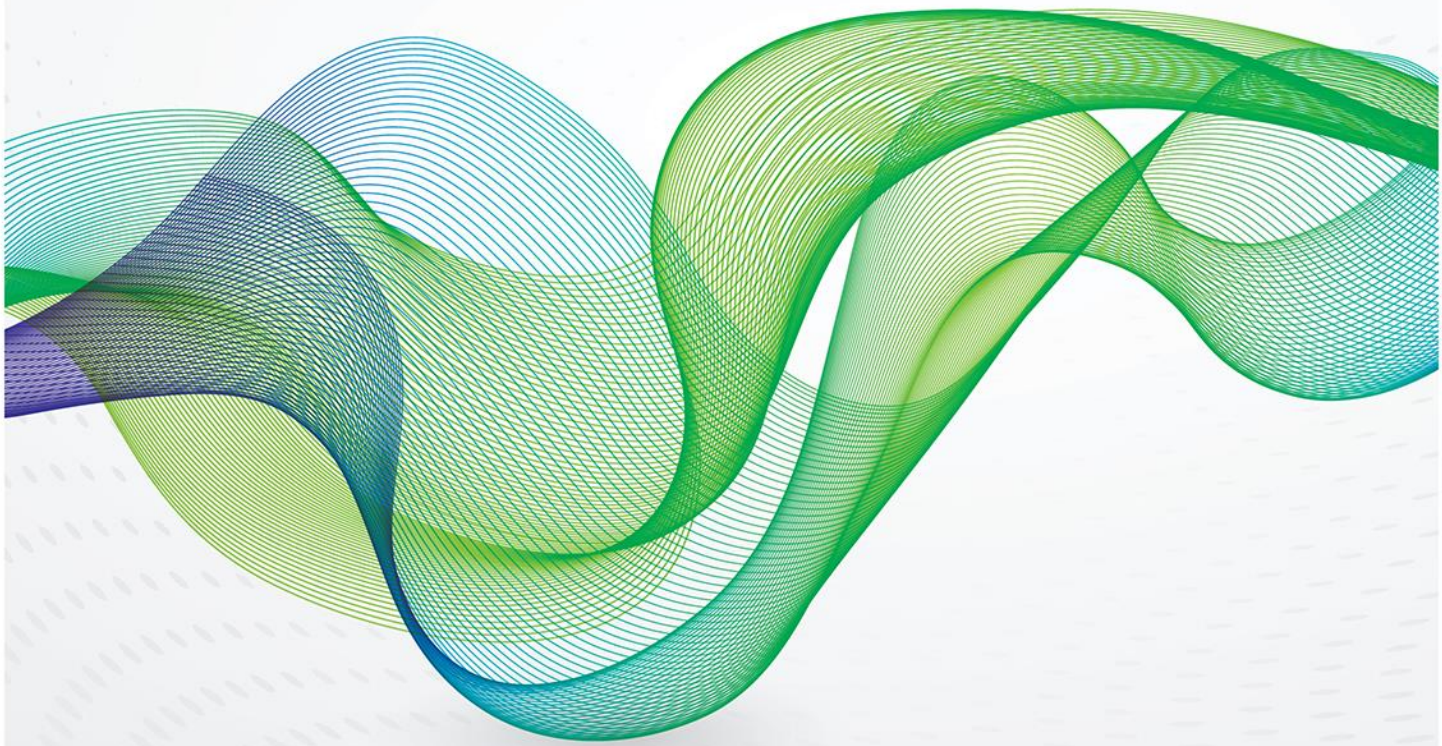
The US Tight Oil Revolution and Its Impact on the Gulf Cooperation Council Countries:

Beyond the Supply Shock



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Bassam Fattouh

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1. Introduction

The oil industry has a long history of alarmist forecasting for supply and demand, which has often proven to be quite wrong. Fears in the 1950s and 1960s that oil demand growth was unsustainable and would lead to unaffordable oil prices were only partially correct: prices in the 1970s and early 1980s did spike but these spikes were followed by a global economic recession that, along with the discovery and development of major new oil provinces outside the Middle East (the North Sea, Alaska, Mexico) and the growth in the use of gas for power generation, confounded those apocalyptic views. Far from choking off demand, oil prices collapsed in the mid-1980s ushering in nearly two decades of relatively low oil prices and inadequate investment in upstream and refining assets. Following the Asian crisis of the 1990s, which sent oil prices down to $10 per barrel, some commentators predicted that the world would remain awash with oil.[1] Almost a decade later, oil prices touched a historic high, just below $150 per barrel, in July 2008.

The industry's poor record in predicting fundamental shifts in the oil market has been made worse by recent developments in the US energy scene. Not only did most industry and market analysts fail to predict the scale of the 'tight oil revolution' in the first place, but now that the pendulum has swung in the opposite direction, towards plentiful US supply, many observers expect the growth in tight oil to transform global oil markets.[2] Indeed, the US tight oil revolution has shifted the market perception from oil scarcity a few years ago to one of oil abundance. Some have warned that 'the world might be drifting into an oil price shock', describing the current situation as 'very reminiscent of the period 1981–86 which culminated in the dramatic 1986 oil price collapse'.[3]

Given the recent shifts in oil market dynamics, many questions are being raised about the future role of the Middle East and its position in the global political, economic, and energy order. Some analysts believe that the impact of the shale revolution on the Middle East will be transformational. For instance, Naím (2014) argues that:

> ... while Saudi Arabia and other Middle East producers will continue to be important players in the global energy markets, their dominance enjoyed for most of past century will no longer be the central feature of this market. The implications of this trend are enormous, ranging from the military to the commercial and perhaps even the social.[4]

Will such predictions about the role of the Middle East more generally, and key GCC producers more specifically, turn out to be correct this time round?5 To be able to answer this question, it is important to analyse the increase in US tight oil production from both a US and a global perspective. After all, oil markets are highly interconnected and the ultimate impact of US tight oil growth will depend on many moving parts, with developments in the Middle East being key to shaping oil market outcomes.

While it is true that the impact of the increase in US production on prices and on oil market dynamics is yet to be fully felt, as some of the underlying forces still need time to unfold and need to be fully understood, it is important to provide a general framework to help us analyse the US shale revolution and its potential impacts on oil markets and key Middle East producers. In this paper, we propose a broad framework based on three main aspects:

(i) the US tight oil revolution as a positive oil supply shock – with the potential to transform into a global supply shock if hydraulic fracturing technology successfully diffuses to other parts of the world (Section 2);

(ii) the US tight oil revolution as a force disrupting the existing trade flow patterns of crude oil, petroleum products, condensates, and NGLs (Section 3);

(iii) the development of US shale as a powerful force behind the shift in market perceptions, not only from a position of oil scarcity to one of oil abundance, but also as a shift in terms of the USA's aspiration to achieve energy independence and how this would impact US foreign policy and its relations with other players, including key Middle East oil exporters (Section 4).

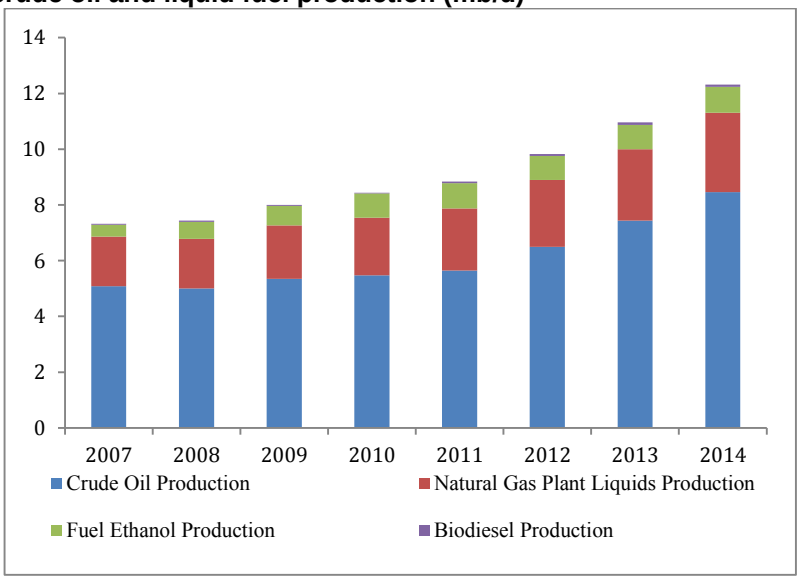
2. The US tight oil revolution: the supply shock

Although the oil market has witnessed many structural shifts in recent years,[6] one important market development – with far-reaching consequences on oil market dynamics and on the behaviour of market players – stands out: the sharp rise in US oil output driven by high oil prices and technological innovation (hydraulic fracturing) which allowed the exploitation of shale oil and gas reserves on a large scale. The received wisdom, only a decade ago, painted the picture of a US economy becoming increasingly reliant on oil imports, especially from the Middle East. Quite the opposite has happened: Overall US oil imports have been declining and now Canada, not the Middle East, is by far the most important foreign supplier of oil to the USA.[7]

The US oil supply shock

The size of the US oil supply shock has been nothing short of phenomenal. From a position of negative growth in 2008, US crude oil production growth turned positive in 2009 and amounted to 840,000 b/d (barrels per day) in 2012 and 950,000 b/d in 2013, with growth expected to exceed the 1 mb/d (million barrel per day) mark in 2014 (see Figure 1). An important feature of the shale revolution is the rapid growth in NGLs, driven by increased drilling activity in liquid-rich basins. Over the period 2008 to 2013, the USA added around 800,000 b/d of NGLs, with production of NGLs exceeding 2.5 mb/d in 2013. This impressive performance has been driven in large part by the development of shale resources. From less than 1 mb/d in 2010, tight oil production increased to more than 3.5 mb/d in the second half of 2014. In its *AEO2014* Reference case, the EIA estimates tight oil production will reach 4.8 mb/d in 2021, comprising more than 50 per cent of total US production compared to 35 per cent in 2012.[8] US production of ethanol increased from around 220,000 b/d in 2004 to close to 900,000 b/d in 2013, though in recent years its growth has slowed due to a variety of factors including saturation in the gasoline market and vehicle and infrastructure issues.[9]

Figure 1: US crude oil and liquid fuel production (mb/d)



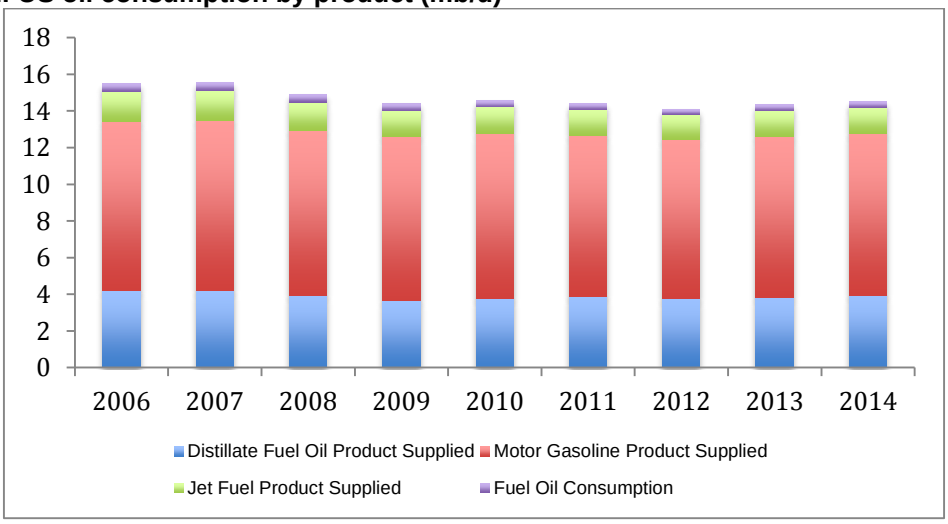
Source: EIA; Estimate for 2014.

These developments on the supply side have reversed two decades of secular decline in US liquid production. US crude oil and liquid fuel production increased from around 7.3 mb/d in 2007 to above 11 mb/d in 2013 and 12.6 mb/d in 2014 (June 2014), constituting one of the key areas of liquid-supply growth in the world. In 2012 and 2013, the USA added 980,000 b/d and more than 1 mb/d of liquid production respectively. This achievement is remarkable. As the 2014 BP Statistical Review of World Energy notes,

> ... only Saudi Arabia has ever had a bigger increase than the US in 2013 [and historically out of nine times in which production rose by more than 1 million b/d] six of those nine times the increment resulted from the ability to tap spare production capacity. In terms of 'organic growth', based on capacity expansion, last year's increase (2013) therefore was the fourth biggest in history.[10]

There have also been some important changes on the demand side. US gasoline consumption has declined from its 2007 peak of around 9.3 mb/d to 8.7 mb/d in 2013 (see Figure 2). While US gasoline demand is responsive to changes in household income and gasoline prices and consequently part of this decline is reversible, another part of the decline is permanent, induced by structural transformations such as changes in drivers' behaviour, the switch to more efficient vehicles, and more assertive government policies in areas of vehicle efficiency and/or increasing the penetration of hybrid and electric cars. US consumption of distillate fuel oil has also declined from its peak in 2007 of around 4.2 mb/d to 3.84 mb/d in 2013. Unlike gasoline, distillate demand is more responsive to changes in economic activity, either measured by GDP or by industrial production. As the economic recovery in the USA consolidates, consumption of distillates could increase, but it may take some time before it surpasses its 2007 levels.

Figure 2: US oil consumption by product (mb/d)



Source: EIA.

These emerging trends on the supply and demand side have had major implications on the domestic and the international oil scene. US dependence on imported oil has declined drastically over the past few years: from 10 mb/d in 2007, net imports have fallen to 7.6 mb/d in 2013, and are expected to fall below the 7 mb/d mark in 2014 (see Figure 3). The origin of imported crude oil has also changed. In 1990, the Middle East Gulf supplied almost 30 per cent of US crude oil imports. In 2013, this share declined to 25 per cent. Exports from producers in West Africa and North Africa to the USA have been reduced to a trickle as the increase in US production has backed out imports of light crude oil.[11] In contrast, the share of imports from Canada has increased from around 10 per cent in 1990 to more than 33 per cent in 2013 (Figure 4), a trend which is likely to consolidate as Canada continues to enhance its production capacity, and as new infrastructure is put in place.

Figure 3: US net crude oil imports, mb/d

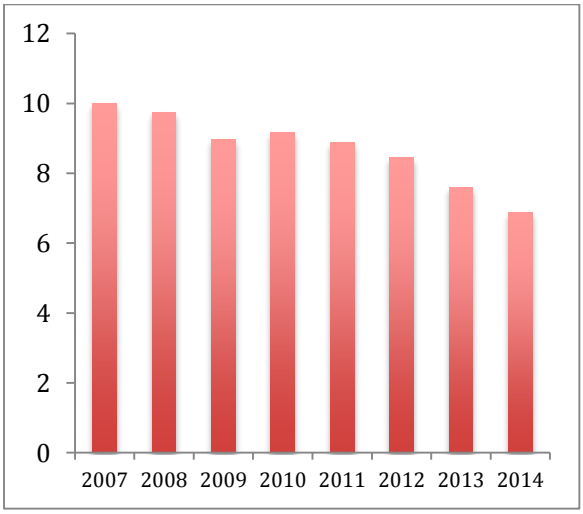
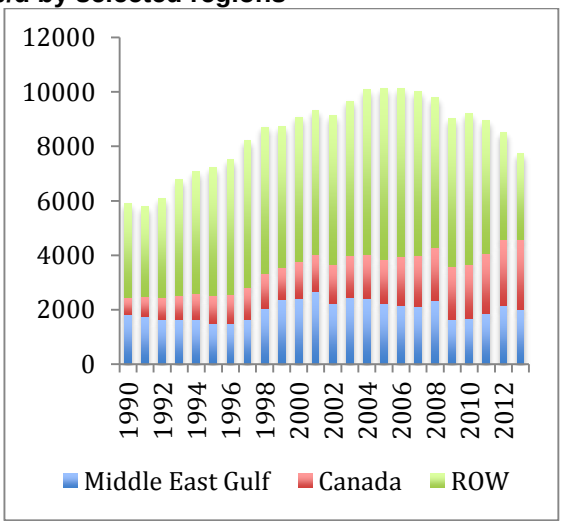


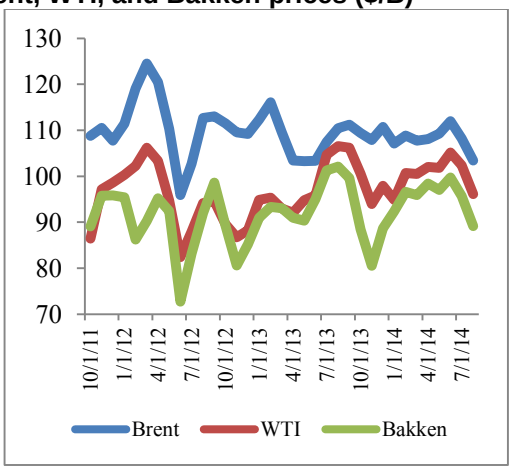
Figure 4: US net crude oil imports, thousand b/d by selected regions



Source: EIA.

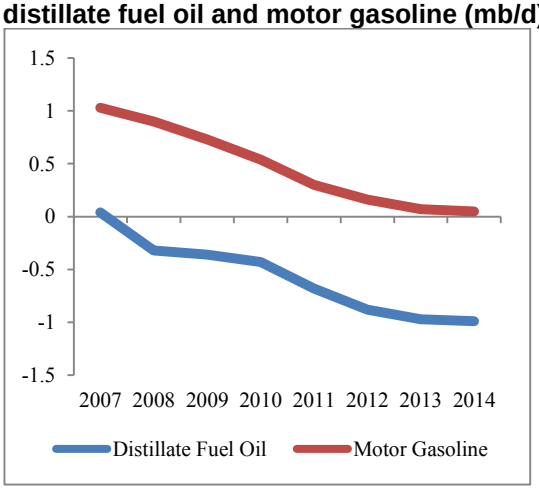
The increase in domestic oil production, in conjunction with bottlenecks in transportation and pipeline infrastructure, has caused some wide movements in price differentials, not only between international benchmarks (such as WTI and Brent) but also between prices of US local crudes (Figure 5). The cheaper local crudes have improved the competitiveness and profitability[12] of US refining centres; this has increased refinery utilization rates, which has resulted in a higher supply and exports of petroleum products.[13] Net exports of distillate fuel oil reached close to 1 mb/d in 2013, while gasoline net imports have almost fallen to zero (see Figure 6). The increase in petroleum products exports along with the decline in crude oil imports have played an important role in reducing the overall merchandise trade deficit of the USA.[14]

Figure 5: Evolution of Brent, WTI, and Bakken prices ($/B)



Source: Reuters.

Figure 6: Net imports of distillate fuel oil and motor gasoline (mb/d)



Notes: Motor Gasoline includes Finished Motor Gasoline and gasoline blend components.

Source: EIA.

The US oil supply shock is here to stay

In short, in the last few years, the US oil scene has been subject to major transformations. For decades, the country's oil consumption rose and its oil production fell; its import dependency thus increased. Each of these trends has now been reversed. Looking ahead, these new trends are likely to consolidate, although wide uncertainties relating to the full potential of US tight oil growth remain. In its 2014 Annual Energy Outlook, the EIA emphasizes that the:

> ... growth potential and sustainability of domestic crude oil production hinge around uncertainties in key assumptions, such as well production decline, lifespan, drainage areas, geologic extent, and technological improvement – both in areas currently being drilled and in those yet to be drilled.

Therefore, it should come as no surprise that projections of future tight oil supply growth differ widely, according to the underlying assumptions. For instance, in the High Oil and Gas Resource case, the EIA projects that domestic crude oil production will increase to nearly 13 mb/d before 2035, whereas in the Low Oil and Gas Resource case, US oil production is expected to reach 9.1 mb/d in 2017 before falling to 6.6 mb/d in 2040. The large difference in these two scenarios reflects uncertainty about the potential of tight oil production. In the High Oil and Gas Resource case, tight oil production would peak at 8.5 mb/d in 2035 – in comparison with the Reference case peak production rate of 4.8 mb/d in 2021. In contrast, in the Low Oil and Gas Resource case, tight oil production peaks at 4.3 mb/d in 2016 and then declines through 2040.

Given the wide spread of these projections, it is only possible to make some general observations regarding the potential of US tight oil growth. First, some analysts have been sceptical about the 'financial' sustainability of shale producers in the USA.[15] For instance, some compare the investment in shale plays to a 'Ponzi' scheme, warning that the bubble would collapse when companies ran out of financing to drill more wells. These analysts point out that companies operating in shale plays have not yet succeeded in achieving a positive cash flow and they have thus had to accumulate large amounts of debt to finance drilling new wells. However, while it is true that operating cash flows have fallen short of capital spending in the first years of shale development, this factor will not determine the future sustainability of US tight oil production. The EIA, in its Annual Energy Outlook (2014), argues that future production will depend ultimately on 'the resource base and the rate of technology advances that lower drilling cost or raise its productivity'.[16] In any case, the finances of shale companies have continued to improve, as they have accelerated the shift away from natural gas towards oil production. Analysts' consensus forecasts indicate that the operating cash flows of leading shale companies will show an excess of about $2.4 bn over their capital spending in 2015.[17]

Second, most evidence indicates that companies operating in shale plays continue to improve their productivity and recovery rates, although there remains a huge variability across and within shale plays. Such productivity improvements are reflected in a number of areas. Recent evidence shows that in five of the six US shale plays, there have been increases in oil and natural gas production per rig over the past few years, with the Eagle Ford Shale leading the increased production of oil per rig, while the Marcellus Shale has led the increased production of natural gas per rig.[18] Shale producers are drilling and fracking longer laterals, while their ability to target the

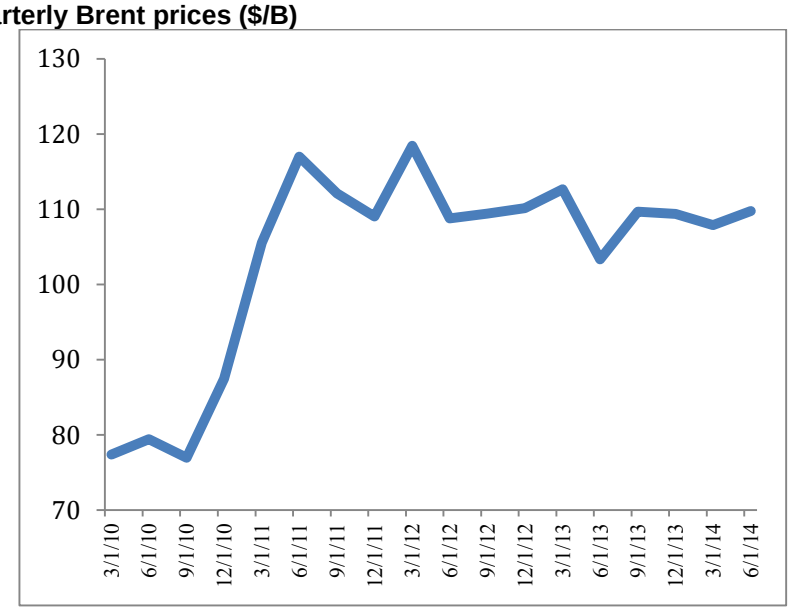
highest-yielding parts of shale plays is also increasing. Technological innovations are likely to consolidate and enhance these productivity gains (examples include: drilling in multiple oil and gas bearing formations and improvements in well spacing).[19]

Therefore, from the perspective of a GCC producer, it is important for policy makers not to bet on the bust of the shale boom anytime soon. In the current environment of relatively high oil prices, tight oil production will continue to grow. There is, however, wide uncertainty on the growth potential of US tight oil and on how long before the growth in output starts tapering off.

Counter-shocks and spare capacity: the role of the Middle East

Despite the robust US supply performance over the past few years, a US-centric view of oil market developments often results in a distorted picture of global oil market dynamics. Putting the US positive shock in a global perspective makes this point very clear. In the last three years, US oil supply growth has been almost completely offset by losses in other parts of the world and as a result there has been almost no shift in the global supply curve. The US shock and this 'counter shock' go a long way in explaining why oil prices have continued to oscillate within a relatively narrow range since 2012, despite wide macroeconomic uncertainty and a rapidly deteriorating geopolitical situation in many parts of the world.[20] While the sharp increase in tight oil production has had a localized impact on US crude benchmarks over the last three years – as seen in the temporary dislocation of WTI and the large discounts of regional grades such as Bakken,[21] the quarterly average Brent price has been above the $100 per barrel mark for the last 14 successive quarters (see Figure 7).

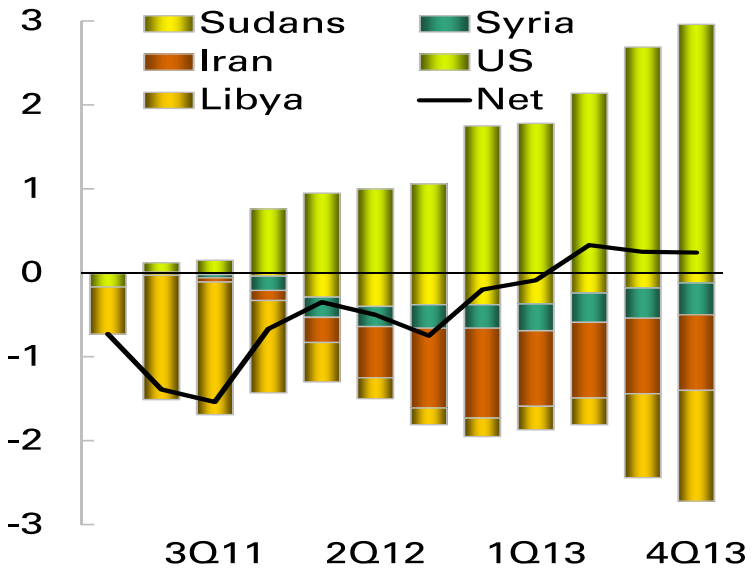
Figure 7: Quarterly Brent prices ($/B)



The Middle East and North Africa (MENA) has been central to this outcome in two very different respects. First, the region has been the main source of the counter supply shock. Geopolitical outages in MENA – particularly from Iran, Libya, Iraq, Syria, and Yemen – have resulted in large

losses from the market for a prolonged period of time. Between 2011 and 2013, it is estimated that more than 1,600 million barrels of oil were lost due to outages arising from countries affected by the Arab Spring and due sanctions linked to Iran's nuclear programme. These supply losses matched the supply gains from the USA (see Figure 8).[22]

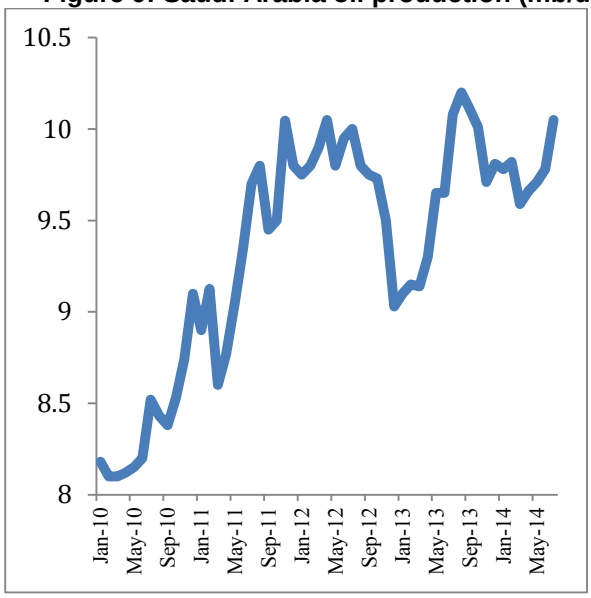
Figure 8: Disruptions offset US supply gains (mb/d)



Source: BP.

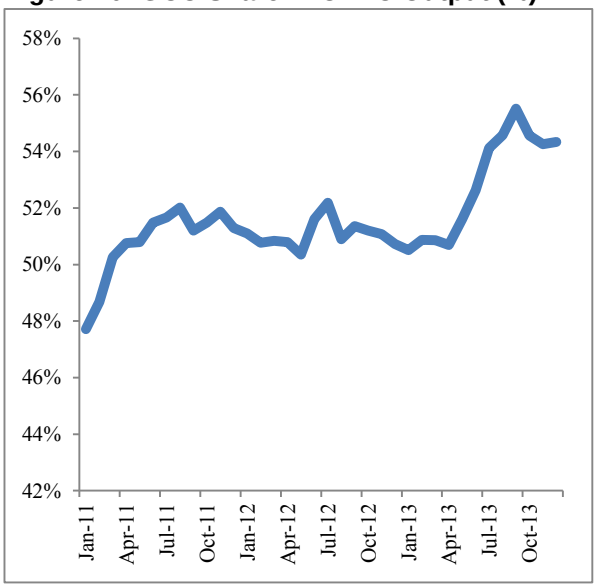
Second, the extent of these losses has meant that the growth in US tight oil production has not itself been sufficient to balance the market; GCC producers have therefore had to ramp up production to fill the gap. Oil production from Saudi Arabia has been at a historically high level reaching above 10 million b/d (see Figure 9). The combined output of Saudi Arabia, Kuwait, Qatar, and the UAE has risen from around 14 mb/d prior at the start of the Arab Spring to above 16 mb/d for much of the last three years. This has not just been an increase in absolute terms. Problems affecting other OPEC members have led to the Gulf States' share of total OPEC production rising above 50 per cent since the beginning of the uprisings resulting from the Arab Spring – exceeding 55 per cent in September 2013 (see Figure 10). This highlights a dimension that is central to the analysis of oil markets: the world's spare oil production capacity is still concentrated in the GCC, mainly in the hands of Saudi Arabia and, to a lesser extent, in Kuwait and the UAE. If there are disruptions, spare capacity can be used to fill the supply gap, helping to stabilize oil prices and maintain global stocks at a healthy level.

Figure 9: Saudi Arabia oil production (mb/d)



Source: Reuters, OPEC, MEES

Figure 10: GCC Share in OPEC Output (%)



Source: MEES, Energy Aspects.

Low-cost producer versus high-cost producer

In addition to its supply growth potential, the position of an oil producer on the global cost supply curve also matters. In this respect, it is important to note that the nature of tight oil wells is very different from the conventional ones found in the Middle East. For example, the natural decline rate of a tight oil well is high, in most cases between 50 and 70 per cent per annum, producing a sharp fall in output in a field unless further hydraulic fracturing is carried out and new wells are brought online. In addition, funding the upfront capital costs (to hold acreage, to add infrastructure such as roads and gathering pipeline networks, to delineate sweet spots/completion, and to drive growth) together with the high running costs of hydraulic fracturing processes, make the total cost far greater than that of production from conventional wells,[23] though it is impossible to put an estimate on the cost given the wide variation within and across shale plays.[24] Given the very different nature of production from shale, a high-cost producer, such as the USA, could not squeeze out a low-cost producer if the low-cost producer decided to compete for market share and in the process was willing to accept a lower price.

The implications of the introduction of a high-cost marginal producer for oil market dynamics can be important. First, one could argue that a high-cost producer such as the USA would introduce greater elasticity to the supply curve – with oil supply becoming more responsive to upward and downward price movements. A more elastic supply curve would help put a floor and a ceiling on the oil price, which is highly desirable from the point of view of GCC producers, as long as the floor and the ceiling are within what producers consider 'reasonable' and 'acceptable'.

Second, in the face of a supply squeeze, GCC producers may decide to compete for market share. This would weaken oil prices and undermine the financial position of some high-cost

producers such as the USA, Brazil, and shale producers, affecting their long-term investment decisions and their production profile. Despite oil prices having hovered around $100 for the last few years, rising exploration and development costs are constituting a challenge to oil companies; CEOs of some of the big majors have stated publicly that $100 a barrel has become the new $20 in the oil business.

However, there are limits to how far GCC producers can tolerate a decline in revenues, as Gulf monarchies have historically overseen large welfare states that have channelled oil and gas revenues into social security, health, education, and the provision of employment as part of these countries' implicit social contracts. They have also responded to the upsurge in political turmoil across the region by further increases in their social spending. In addition to increased spending on their local economies, Gulf States have increased their financial support for some of their ailing strategic partners in the region. To fund their increasing expenditure outlays, GCC oil exporters have become even more dependent on high oil revenues, forcing them to assume higher oil prices for their budgets to break even.[25] Therefore, a counter argument to the suggestion that low-cost producers could compete on cost terms for market share is: although the cost of producing Middle East oil is relatively low, the oil price needed to maintain the economic and political stability of many of these countries has increased.

While such an argument has some validity, it would be overly simplistic to treat a calculated breakeven price as indicative of the new price floor for the world's major producers. Key Gulf oil producers – such as Saudi Arabia, Kuwait, and the UAE – have low foreign and domestic debt, as well as large reserves of foreign currency; this provides a large fiscal buffer, meaning that they are in a better position to deal with lower oil revenues for a short period, especially when compared to other producers in OPEC – such as Iran, Venezuela, and Iraq. Also, producers do not have to balance their budget on an annual basis. These factors imply that key GCC producers could behave strategically if faced with heightened competition. Therefore, rather than assuming a less central role over the next few years, the output decisions of some key GCC producers will be central for oil price outcomes: their output decisions matter more in a market where there are strong expectations and signs of oversupply.

Third, the source of supply growth matters. The squeeze from a low-cost producer such as Iraq should be treated differently from that of a high-cost one, as the output of a low-cost producer is likely to be less responsive to price movements: a low-cost producer could still generate large rents even in a relatively low-price environment. This is why Iraq is central to any low oil price scenario; this is not only because the expected increase from Iraqi production would constitute a major source of squeeze for a key producer such as Saudi Arabia, but also because Iraq is a low-cost producer whose supply is less responsive to price movements and hence could affect cohesion within OPEC.[26] In other words, Iraq's output, pricing, and marketing strategies would constitute a far more important source for concern from a GCC perspective than those of high-cost US shale producers – whose supply is expected to be more responsive to price signals, particularly as low oil prices will affect the economics of shale projects.

Investment response

Given the size and the cost of developing Middle East oil reserves, most international organizations predict that meeting long-term growth in oil demand implies higher, rather than lower, reliance on investment in the Middle East towards the end of the next decade. For instance, in its latest World Energy Investment Outlook,[27] the IEA stresses that investment in the Middle East has to increase in order to offset declines elsewhere. In an environment of high uncertainty, the option to wait and not invest until new information becomes available is highly valuable. Much of the analysis on the impact of the US tight oil revolution implicitly assumes that some key producers in the GCC (such as Saudi Arabia) will not behave strategically and alter their investment and expansion plans amidst a large degree of supply and demand uncertainty. The investment decisions taken today will impact the future growth of oil supply; by altering expectations about long-term oil supply–demand balances these decisions can affect both the long-term oil price and the shape of the forward curve.[28]

While some MENA producers have the capability to undertake the necessary investment to increase productive capacity, but may strategically decide to postpone their investment plans, most will struggle to increase production due to variety of barriers. Many MENA countries have large resource endowments, but transforming these endowments into revenue requires long-term strategic planning and large investments, including the attraction of foreign investment and technology into the sector. The outlook for foreign investment has also been impacted by unattractive fiscal terms and recent geopolitical events, as the security environment across much of the region has worsened.[29] NOCs in MENA are not of uniform quality, and while some score highly on commercial performance, human resources, and technology, others perform very poorly and have to rely heavily on foreign companies for the exploration and development of their oil reserves. In a recent report, APICORP highlights additional difficulties:

> ... a strong likelihood that the costs of large-scale energy projects will continue escalating above and beyond general inflation [and the difficulty of] securing medium to long-term financing.[30]

These barriers to investment cast a shadow over the capability of the region to increase its productive capacity in the next decade.

From a US supply shock to a global supply shock

A key uncertainty facing the GCC countries is the potential diffusion of shale technology outside the USA. IHS identifies 23 play areas that can be considered as high-ranking, and to be of similar quality to those in North America.[31] Technically recoverable resources, including those in the USA, are estimated to stand at 345 billion barrels; in other words, around 10 per cent of the world's estimated oil resources are in shale or tight formations.[32] Given this large reserve base, a replication of the US success in other parts of the world could result in a global supply shock, squeezing GCC producers out of key markets.

Despite the massive size of unconventional reserves, it remains unclear as to whether the US tight oil revolution could be easily replicated in other parts of the world. The development of US

shale has come at a huge cost – hundreds of expensive experimental wells have been drilled and large amounts of debt have been accumulated. There are also doubts on whether the conditions present in the USA could be replicated elsewhere. High oil price and innovation in hydraulic fracturing were key enabling factors. But other US-specific factors have also been important. These include: favourable mineral rights with land ownership; large block holdings; an extensive network of pipelines; a very dynamic exploration and production industry; strong logistics and service providers; large rig availability; deep financial markets and cheap credit; and liquid futures markets allowing producers to hedge production forward. Compare these conditions for instance with Russia, where government owns the underground reserves; corporate landscape is dominated by large vertically integrated companies; the service sector is weak; rigs are not widely available; the tax system is in need of reform; and capital and derivatives markets are thin.[33] For these reasons, the tight oil revolution is likely to remain mainly a US phenomenon for the foreseeable future. Elsewhere, most countries will struggle to replicate the North American experience at a large scale. According to the IEA, Light Tight Oil (LTO) production in 2035 will reach 450,000 b/d in Russia, 220,000 b/d in Argentina, and 210,000 b/d in China, but elsewhere it will stay in the tens of thousands of barrels per day.[34] These are important additions, but are not enough to transform oil market balances fundamentally for the next decade. However, the potential spread of the shale revolution globally could affect market expectations about future oil balances.

From a supply shock to a demand shock

Another key uncertainty is the impact of the shale revolution on oil demand, particularly on the degree of substitution away from oil into gas in the transport sector as the prices of crude oil and natural gas in the USA have widely diverged. This gap has been generally increasing since January 2009 and has widened in recent years. Gas is already displacing coal in the power sector in the USA.[35] The key question is whether natural gas will be successful in displacing oil in the transport sector – the key source of oil demand growth both in the USA and elsewhere in the world.

Some have argued that the shale gas revolution has offered real opportunities for the substitution of gas in the transport sector in the USA. Research at Citibank[36] also concludes that 'one of the many unforeseen ripple effects of the US shale revolution is a push to substitute natural gas for oil'. The report points to multiple areas in which this may take place (or is already taking place): in light transport, heavy-duty trucking, bunker fuel in seaborne transport, petrochemicals, and the power sector.

Despite five years of very low US natural gas prices, there have been very few signs of widespread substitution from oil to natural gas in the transportation sector. Some companies are investing in R&D, attempting to take advantage of the wide price differential between the two fuels, while some companies have been switching to natural gas-fired trucks. But the numbers remain relatively small. For instance, the EIA (2014) projects the share of compressed/liquefied natural gas in the US transport sector will be around 3 per cent of the transport sector's total consumption by 2040.[37] In addition to relative costs, other factors, including operational, financial, regulatory, and mechanical challenges, also affect fuel choices.[38] Outside the USA, it is worth

noting that in emerging countries like India and China, natural gas prices remain largely oil-linked and thus offer little price advantage. For these countries, environmental factors have been the main driver for the switch into gas-fired vehicles.

The perfect storm?

It is not that the growth of tight oil has had no impact on global oil market dynamics. Without the growth of US tight oil, global oil market fundamentals would have been entirely out of balance in the last few years and oil prices would have had to increase to a much higher level to clear the market. The key point is that while the US oil supply shock is a crucial factor affecting global price outcomes, it is by no means the only determinant shaping global oil markets. The idea that one factor in the market could move us to a new price path is simplistic. For the coming years to be significantly different from the past few years, and for global oil prices to find a new persistent low norm that could have an enduring impact on the revenue base of the GCC producers, there would have to be a perfect storm of:

- sustained weak oil demand growth due to a fragile macroeconomic backdrop, demand destruction, and/or large substitution into gas in the transport sector;
- a sustained increase in US production growth;
- a shock in non-OPEC supplies outside the USA, in part due to the spread of the shale revolution to other parts in the world;
- a sharp increase in Iraqi production, and a breakdown in OPEC cohesion.

The long-term low-price scenario also implicitly assumes that some key producers, such as Saudi Arabia, will not behave strategically and alter their output strategy and investment and expansion plans, amidst a large degree of market, policy, and regulatory uncertainty.

Given that there are many moving parts in the oil market, several scenarios can play out, with the 'low oil price' scenario not being the most probable one. Market conditions in the last few years indicate that the oil market is subject to a different set of dynamics from that shown above

- demand growth continues at a reasonable rate,
- non-OPEC supply performance outside the USA continues to disappoint,
- costs of production continue to spiral as producers develop more difficult reserves,
- key producers persistently suffer from outages and delays, and
- OPEC cohesion remains quite strong as most of its members continue to produce close to their maximum capacity.

Given these dynamics, and the fact that US tight oil has introduced more elasticity to the supply curve, other more probable scenarios can play out. For instance, rather than a sharp and discrete movement in the oil price in both directions, it is possible to envisage a scenario in which the oil price adjusts downwards to a 'new equilibrium' to reflect the US positive supply shock (while continuing to oscillate within a narrow range) but this new level would be high enough not to threaten the revenue base of GCC producers.[39] However, in the unlikely event that the perfect storm does materialize, it would be very difficult to construct a case that oil prices would still remain buoyant, and if oil prices fell, tight oil production growth would slow down given its

relatively high cost of production. This creates an internal inconsistency in the argument put forward by many in the market – that tight oil growth would lead us to an era of cheap oil – because if prices fall on a sustainable basis, it would not be profitable to produce from these resources. After all, the primary reason for the rapid growth in tight oil output in the last few years is that oil prices stayed high and above $100 for a sustained period.

3. Beyond the Supply Shock Analysis

From the perspective of Middle East producers, the growth in US tight oil should not just be considered as a supply shock. The impact of the shale revolution goes beyond the direct effect of shifting the global supply curve; it has resulted in a shift in perception from a position of oil scarcity to one of oil abundance, affecting long-term prices and the shape of the forward curve. The shale revolution has also changed the dynamics of crude oil and petroleum product trade flows with implications on prices, differentials, marketing, and pricing strategies. It has also changed the perception of the geopolitical importance of the Middle East in the global energy system within some US policy circles; this has potential implications for US foreign policy and on the future relationship of the USA with key Middle East producers.

Changes in crude oil trade flows

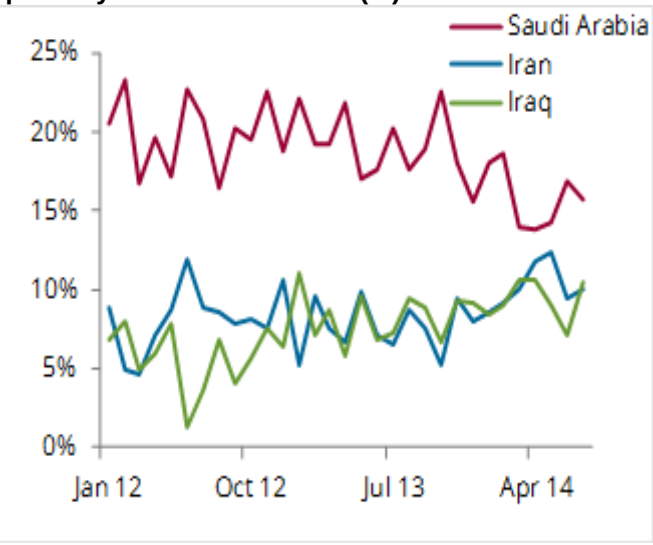
The US tight oil revolution has resulted in a drastic shift of crude oil trade flows. Growing US domestic production has meant that refineries in the USA have made changes in order to accommodate the increase and this, together with a drop in domestic demand, has resulted in the pullback in US crude imports. Given that roughly 96 per cent of the 1.8 mb/d growth in production from 2011 to 2013 consisted of light sweet grades with API gravity of 40 or above and sulphur content of 0.3 per cent or less, light crudes have borne the brunt of that adjustment,[40] with producers of light crude oil (such as Nigeria, Angola, and Algeria) being the worst affected. However, other GCC exporters such as Saudi Arabia have also been reducing their exports to the USA, especially at times when benchmark prices in the USA weaken.[41] The inability of traditional suppliers to market their crude in the USA has forced them to look for alternative markets. For instance, West African barrels, helped by low freight rates, are proving to be attractive in Asia at a time when other crude exporters – such as Russia, Mexico, and Venezuela – are also trying to move away from Western markets and capture higher share in the main growth market of Asia. Once the Panama Canal is widened, the shift towards Asian markets will only intensify.

The diversion in trade flows is already having important implications for Middle Eastern producers, which have not yet been fully appreciated. The growing economies of Asia have been heavily reliant on Middle Eastern suppliers, particularly from the Gulf, through most of the last decade. This is now starting to change and Middle Eastern exporters face much tougher competition in a key market. In order to maintain their market share in the fastest-growing region, GCC countries will have to compete more aggressively in Asia. This will not be driven only by competition from outside the region, but also from within. The effects are already visible: Iraq has been offering competitive official selling prices (OSPs) for its main export in an attempt to capture market share. Iran has used its own vessels to sell crude on a delivered basis, offering discounted freight rates. The impact has been an erosion in Saudi Arabia's share in some key

Asian markets (see Figure 11). For instance, average import levels by non-OECD Asian economies have increased by over 1 mb/d (~10 per cent) between 2012 and mid-2014, of which Chinese imports have risen by 0.7 mb/d (~13 per cent) and Indian by 0.33 mb/d (9 per cent). In China, of that 0.7 mb/d increase, Iraq has seen its exports rise by 0.25 mb/d and Iran by 0.18 mb/d, while Saudi Arabia has seen its exports fall by 0.11 mb/d.

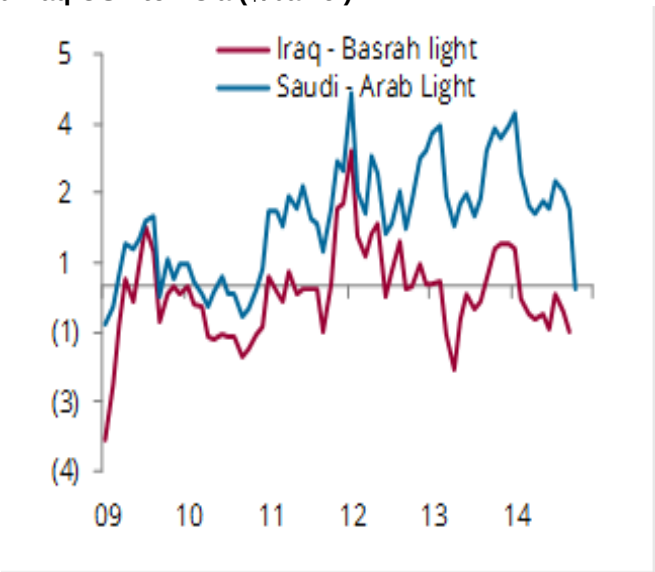
In response to this intensified competition, GCC exporters have been stepping up their efforts to maintain their share in Asia. Kuwait has started to offer its crude on a c.i.f basis, assuming the responsibility for the cost of the goods in transit, providing minimum insurance, and paying freight charges to move the goods to a destination chosen by the buyer. These services amount to an inherent discount embedded in the contracts.[42] Kuwait Petroleum Corporation (KPC) has also been aiming to buy stakes in Asian refineries to secure a market for its supplies.[43] The Indian government has been in talks with ADNOC and KPC to lease some of the space in their newly built Strategic Petroleum Reserves (SPR) caverns in order to reduce the cost burden of holding strategic stocks. Thus, the shift in trade flows is putting pressure on Middle East producers to revisit their crude oil marketing and pricing strategies and to offer Asian buyers more attractive terms. In weak market conditions, the impact is most likely to be felt in the adjustment of crude oil discounts, as has been seen in recent months. As Figure 12 shows, Saudi Arabia has had to cut its OSPs to Asia sharply, to compete with other suppliers.[44] Competition through adjusting discounts may feed into benchmark prices, though the relationship between differentials and price levels is not straightforward. In the medium to the long term, the shift in trade flows could also affect the price formation process itself, with the possible emergence of new benchmarks and a greater role for Asian players in the price formation process.

Figure 11: China, imports by selected countries (%)



Source: Energy Aspects

Figure 12: Saudi and Iraq OSP to Asia ($/barrel)

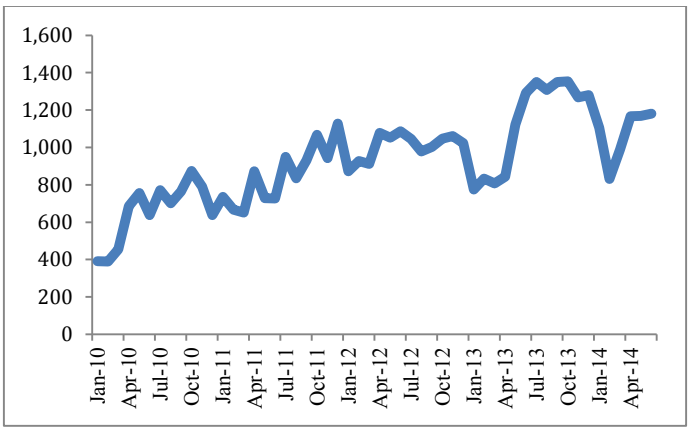


Source: Energy Aspects.

Changes in petroleum products flows

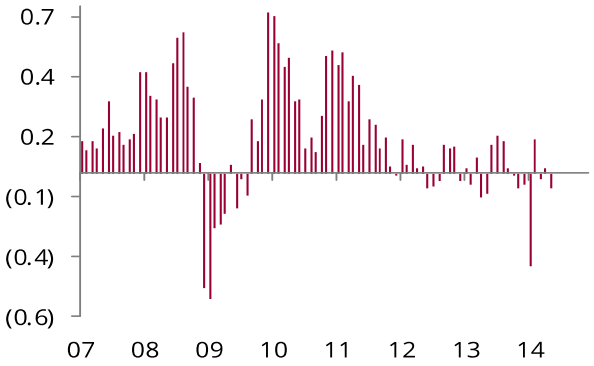
In addition to changes in crude oil trade flows, the petroleum products markets (particularly gasoline and diesel) have also witnessed some major transformations. The growth in the export capacity of the US refining industry, fuelled by cheap domestic feedstock and access to discounted crudes, has seen net imports of gasoline fall to historically low levels while US diesel exports have surged to over 1.2 mb/d (see Figure 13). The Asian refinery landscape is also undergoing some major transformations. Asian refining capacity has risen sharply in recent years and is mainly biased towards hydrocracking. This is most evident in China, where a massive increase in refining capacity has helped boost product exports – including diesel. Furthermore, as China rebalances its economy towards domestic consumption away from energy-intensive exports, domestic diesel demand growth has started to slow down (see Figure 14); combining this with its rise in refining capacity, China became a net exporter of diesel in 2013. The net surplus of diesel in China is likely to continue to rise in the coming two to three years as the rebalancing continues, given that it takes a long time to build new refineries, or to change the configuration of existing ones. Meanwhile, the Russian government's firmly stated commitment to the regeneration of its refining industry indicates that Russian fuel oil output will decline, while that of diesel will increase, during this decade. Although the exact timing of the reduction in fuel oil production remains unclear, as it will depend on when Russian refinery projects are completed, Russia is firmly committed to raising diesel exports to Europe in the coming years.

Figure 13: US exports of diesel (thousand b/d)



Source: EIA.

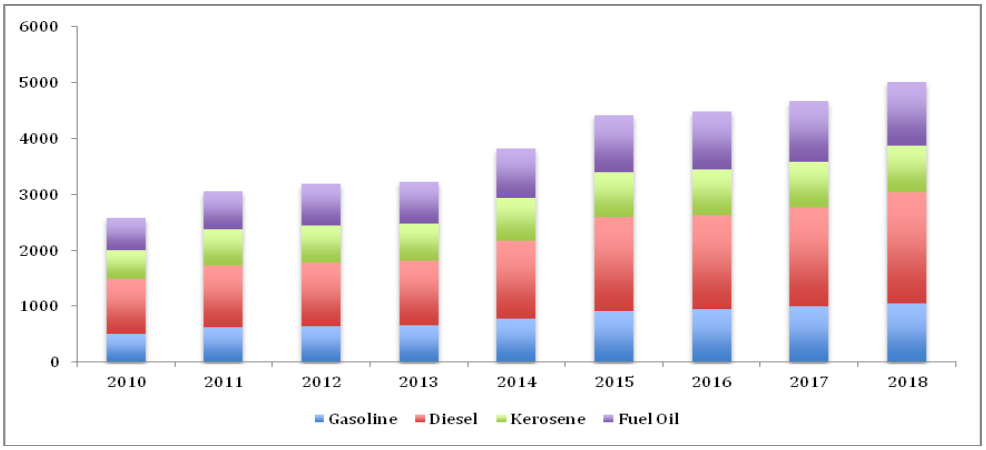
Figure 14: China diesel demand growth, y/y (mb/d)



Source: Energy Aspects.

These changes in the global refining scene are happening at a time when refining capacity in the GCC, mainly in Saudi Arabia, has been expanding fast and is likely to expand further as soon as other GCC countries implement their investment plans (see Figure 15).[45] Many factors can account for this new drive towards the expansion of refining capacity; the most important motivation is that some of the largest GCC oil producers have been forced to import expensive petroleum products, as domestic demand has outstripped refining capacity for certain petroleum products such as gasoline and diesel. Another factor relates to the shift in strategy towards integrating refineries with petrochemical plants. Some of the other drivers are purely technical, being related to factors such as maximizing the yield of high-value products, producing cleaner fuels, meeting more stringent environmental regulations, and reconfiguring refineries to changing patterns in petroleum product demand. A further consideration is the limited availability of gas for use in the power sector, and in some cases the lack of gas infrastructure, meaning that some GCC countries (Saudi Arabia and Kuwait) have no choice but to continue to rely on liquid fuels for power generation, further increasing domestic demand for liquid products.

Figure 15: Evolution of GCC Refining Capacity by Product (2010–18), thousand b/d



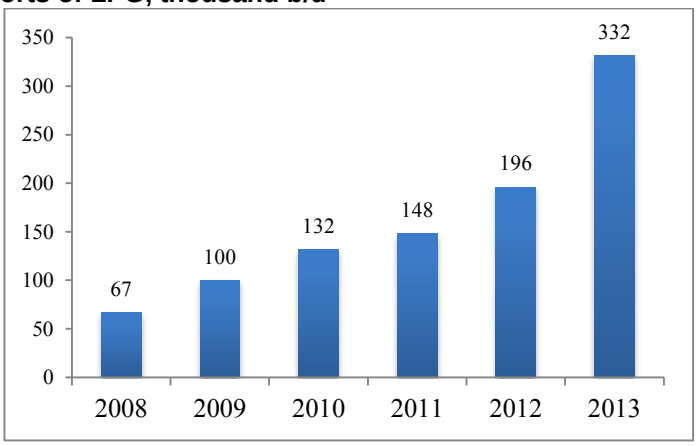
Source: Fattouh and Mallinson (2013).

While the region is expected to continue to be a net importer of gasoline well into the end of this decade, GCC exports of diesel could increase almost four fold.46 As demand growth for diesel falls and net exports from Asia increase, a significant portion of GCC diesel exports will have to head to Europe, a region where the deficit is still rising despite stagnant to falling demand, as refineries in Europe remain largely gasoline- and naphtha-biased. But all major export refining hubs with a diesel bias are earmarking Europe as their top destination, along with Latin America; parts of Africa are the only regions in the world that will be left with a growing appetite for diesel imports. Thus GCC refineries will face stiffer competition in marketing their diesel, putting pressure on global refining margins. While this represents a challenge, it is also an opportunity for GCC producers to establish and develop their trading arms and to play a bigger role in the global petroleum products markets by opening new markets, enhancing their expertise and skills in the trading of petroleum products, and creating trading hubs.47

Changes in LPG trade flows[48]

One of the major developments associated with the US shale revolution, and one that has attracted little attention from market analysts, is the sharp expansion in US liquefied petroleum gas (LPG) exports.[49] The substantial increase in domestic supply has not only meant that US imports of LPG (which mainly come from Canada) have dwindled, but that the USA has now become one of the world's biggest exporters of LPG. From 67,000 b/d or 2.1 million tonnes per annum (mtpa) in 2008, LPG exports increased to more than 0.33 mb/d (10.4 mtpa) in 2013 and in the space of just one year alone, between 2012 and 2013, LPG exports actually rose by more than two thirds (from 0.20 to 0.33 mb/d, see Figure 16). According to the EIA, US LPG exports are expected to persist well into the next decade as NGL output in the USA continues on its upward trend.[50]

Figure 16: US exports of LPG, thousand b/d



Source: EIA.

The sharp rise in US LPG exports is already having wide repercussions on global LPG market dynamics and trade flows. 51 While the bulk of US exports are currently destined for Latin America, it is widely believed that the impact of higher US LPG exports will undermine the position of traditional exporters, mainly those in the GCC. First, as Asian consumers increase their purchase of US LPG in an attempt to diversify their sources of supply and gain access to cheaper LPG, the GCC's share of LPG exports to Asia is expected to fall. For a long time, Asia's petrochemicals market had little choice but to rely heavily on imports from the Middle East, but this is already changing. Many Asian players have already signed export agreements with US propane producers to secure long-term supplies. This trend will continue to accelerate, driven in large part by a desire to diversify sources of supply away from the Middle East, and also by a wish to take advantage of low-cost US propane and butane. Consequently, GCC producers will face more competition in a key market, reducing their share of LPG trade in Asia. Second, LPG prices, together with the existing pricing mechanism, may come under pressure as a result of intense competition from US supplies.

However, it is important to note that the overall impact on prices will depend in large part on the internal dynamics within key Middle East producers – particularly the rapid growth in domestic demand for LPG which is driven by the petrochemical sector – and the impact this may have on their LPG export volumes. While LPG output from the GCC is expected to rise in the next few years, there is large uncertainty regarding the volume available for exports. Internal demand dynamics, the scarcity of ethane in some countries such as Saudi Arabia, and the drive towards diversification imply that a large percentage of the increment in production from the GCC will be used domestically, and hence the potential global impact of increased US supplies on LPG prices will not be severe as some are predicting.[52] Liquid cracking could also offer opportunities for GCC producers to capture a larger share of the higher-value petrochemical specialty products; this would fit within the priorities of GCC governments. Rather than competing for LPG exports, GCC producers may end up relying more on propylene exports. Shipping costs will also provide some support for LPG prices. Shipping and terminal costs alone would be in the range of $200 per tonne, which suggests that the spread between propane CFR Tokyo and spot US Gulf Coast (USGC) prices will have to remain wide in order for the arbitrage to work. The completion of the

Panama Canal widening will reduce shipping costs substantially, but the effect of US LPG on prices will only be felt substantially after that.

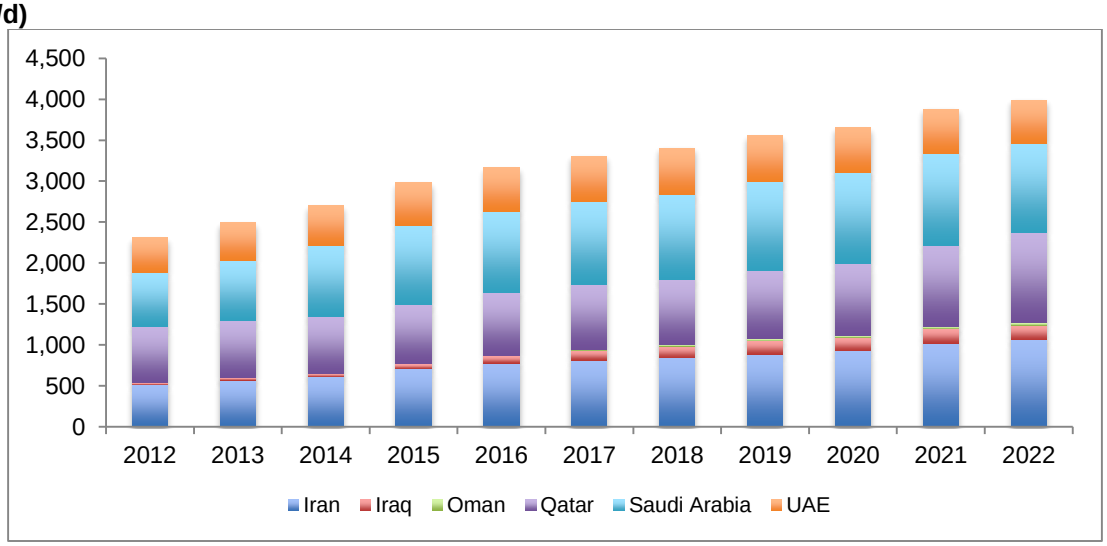
The biggest uncertainty, however, remains as to whether access to cheaper US LPG will induce Asian petrochemicals companies to start seeking alternatives to Middle East naphtha as feedstock; this would have a dramatic effect on LPG and naphtha markets, and consequently on petrochemicals trade. In other words, US LPG exports to Asia could prove to be not only a positive supply shock, but also a shock to the structure of the petrochemical industry and petrochemical trade flows.

Changes in condensate trade flows[53]

An important aspect of the US shale revolution relates to the large increase in condensate output. US condensates from domestic production have traditionally been sold to and processed by refineries, where the naphtha- and gasoline-range compounds are subsequently split from the condensate stream and blended into gasoline pools as reformate to boost refinery gasoline octane levels. However, because US shale production has produced a growing surplus of tight crude oils that naturally contain a high proportion of condensates, and domestic gasoline demand is dwindling, domestic refiners are requiring substantially less plant condensate to meet gasoline-blending needs. As a result, refinery demand for condensates in the US is in long-term structural decline, and is unlikely to prove a ready home for incremental US condensate production in the years to come. In addition, under the existing legislation relating to crude export (put into effect following the oil embargo of 1973) unprocessed condensate streams are classified as a domestic crude oil and are therefore banned from export. In order to capitalize on condensates streams, a number of midstream operators have thus opted to 'split' condensate streams into processed oil products in order to circumvent the crude export ban. When 'split' into its commodity cuts via refining or processing, condensates will yield roughly 60 to 70 per cent naphtha-range materials, followed by LPGs. All of these are permissible for export as refined oil products. In total, some 0.37 mb/d of condensate splitting capacity in the USGC has been announced recently, by a number of US midstream players. Assuming that these USGC facilities will be primarily export-oriented, then these developments suggest that US naphtha exports are poised to expand rapidly from the figure of 63,000 b/d seen in 2013 – which itself was a 29 per cent year-on-year increase from 2012 naphtha export volumes.[54]

US condensate/naphtha exports will be competing with the Middle East Gulf, which will continue to represent the primary source of incremental growth in condensates production globally for the foreseeable future. By some estimates, production of condensates from the Middle East Gulf will increase from some 2.3 mb/d in 2012 to close to 3 mb/d in 2015 and could surpass 4 mb/d by 2022 (see Figure 17).[55] Although part of this increase in production will be absorbed domestically, condensates exports from the region to Asia are nevertheless expected to increase sharply, thus impacting global petrochemical feedstock markets.[56]

Figure 17: Mid-East Gulf Segregated Condensate Supply Outlook-Base Case (thousand b/d)



Source: Al Troner (2013).

Some Asian (and European) petrochemicals producers will be keen to access discounted US condensate/naphtha as this can afford them the optionality to split cheap naphtha and, to a lesser extent, LPG for feedstock use. For Asian operators in particular, access to US condensates will also allow them to diversify their sources of supply. But with shipping costs from the Middle East to Asia being substantially lower, US suppliers will face tough competition. For instance, China has already locked in annual contracts with Iran and is not expected to take any US condensates in the short term.[57] In contrast, Japan and South Korea have shown interest in receiving US condensates,[58] but recent quality concerns over variations in condensate composition and a high level of impurities could pose a non-trivial threat to future cargo deliveries and even undermine long-term contracts.[59] At any rate, Asian interest in new splitter projects has picked up in recent years, on the back of growing petrochemicals demand in the region. The prospect of weaker condensates prices from the USA and Middle East is also providing further incentive for new condensate splitters in the region. While a portion of the naphtha-range material is certain to be blended into gasoline (especially in the Middle East Gulf where demand for gasoline is still rising), more volumes of naphtha will inevitably become available as petrochemicals feedstock across the region.

In short, while the Middle East Gulf will remain the source of condensates and naphtha exports to Asia, the USA's entry (as well as that of other players such as Russia, Australia, and West Africa) into the Asian market and the proliferation of new grades of condensates and naphtha will become key factors affecting prices to the East of Suez; this could result in a highly competitive market. As this supply pressure mounts, substitution away from naphtha towards ethane in the USA and the increasing use of LPG by Asian and European crackers imply a more subdued global naphtha demand growth. These trends are poised to put downward pressure and keep a lid on global naphtha and condensates prices.[60]

Shift in trade flows at times of vertical integration

The growth in US tight oil output has resulted in significant shifts in the trade flows of crude oil, petroleum products, LPG, and condensates. These shifts are resulting in greater competition, which would only intensify as US net imports continue to fall. While Middle East producers have to compete more aggressively to maintain market share in key markets such as Asia, this may not necessarily translate into a sharp fall in benchmark prices. In crude oil markets, the competition will be reflected mostly in more competitive discounts, while in LPG, naphtha, and condensates markets, shipping costs and rising domestic demand (which would limit export availability) can continue to provide support for prices of these products. It is important to stress that these more competitive pressures are taking place at a time when the GCC countries are continuing their efforts to capture more value added through vertical integration into refining and petrochemicals. Petroleum products and specialty product markets are intrinsically more competitive than crude oil markets; GCC producers going down the vertical integration path have yet to come to terms with the necessity of developing new marketing tactics and pricing strategies in this rapidly changing environment.

4. The US Shale Revolution and Geopolitical Implications

A key issue is whether the impacts of the supply squeeze and of the shifts in trade flows, resulting from the US shale output growth, will be big enough to destabilize GCC countries and their position in global oil markets. One view is that the US shale revolution will erode the revenue base of key Middle East producers, with detrimental effects on the survivability of their ruling regimes. For instance, Citibank argues that:

> ... some producer countries … those suffering most acutely from the resource curse may see their leadership come under heightened pressure for economic and political reform, as revenues gradually diminish, raising the risk of creating new failed states in the process [and as a result] importing countries may seek new terms of engagement with new suppliers, re-drawing the map of the international system in the process.[61]

While the previous discussion suggests that GCC producers will face more competition in key markets, the risk of a sharp and sustained fall in oil prices, and hence the collapse of the revenue base of Gulf States, remains small. 62 Such a doom scenario would depend on factors other than the USA's recent supply performance – such as the collapse of the world economy. Under some scenarios, there is the risk that the oil market could become oversupplied, putting a downward pressure on the oil price. But GCC countries still have options in terms of their output policy and/or investment strategies. While the shift in crude oil trade flows will create more competitive markets, there is nothing to suggest that GCC producers can't adjust their pricing and marketing strategies to protect their market share, though some producers will be more effective than others in doing so.

Another view is that the US pivot towards Asia and lower dependency on Middle East oil imports will erode the USA's interest in the Middle East and its 'special' relations with GCC oil and gas

exporters, leading to a gradual reduction in its military presence and in its regional security commitments in the Gulf, and exposing key producers in the region to internal and external threats. It is true that lower dependency on imported oil from the Middle East will mean that the USA has more flexibility in its foreign policy choices and more room for diplomatic manoeuvre. However, US interests in the region are not motivated by securing oil supplies alone, they are also influenced by wider political and security interests; these include protecting Israel's interests in the region, countering terrorism, containing Iran's nuclear programme, and more recently ensuring the stability and the unity of Iraq and fighting against Islamic State.

Furthermore, the oil market is highly interconnected and supply shocks in any part of the world will affect oil prices all over the globe. Given that the USA is still far from achieving the goal of oil independence, it cannot isolate itself from such supply shocks. Even if the USA imported no oil from the Middle East (a goal that now seems more achievable than ever before), it still has strong interests in protecting against supply disruptions, as these could prove costly not only in terms of their direct impact on the USA, but also indirectly through their impact on its trading partners. Having said that, the incidence of supply shocks is likely to be felt differently across different regions, depending on the direction of trade flows, and the USA will become more resilient to shocks as it reduces its dependence on imported oil. The USA will also have more options regarding its energy policy, especially in relation to the accumulation of strategic stocks and also to its export policy. For instance, there have been recent calls that in the era of energy abundance, the USA should use energy as a tool for international diplomacy.[63] Mr Tom Donilon, a former senior advisor to the US President, expresses this very clearly:

> America's new energy posture allows us (Americans) to engage from a position of greater strength. Increasing US energy supplies act as a cushion that helps reduce our (USA) vulnerability to global supply disruptions and price shocks. It also affords us (the USA) a stronger hand in pursuing and implementing our international security goals.[64]

The use of energy in international diplomacy is nothing new; for instance in the past the USA has used energy sanctions as a foreign policy tool. The US energy boom, however, has allowed more flexibility in the use of such tools.[65]

The Asia Pacific region is likely to feel the biggest impact in the event of a physical disruption. Between 1980 and 2012, this region increased its demand from around 10.5 mb/d to almost 30 mb/d – an increase of around in 20 mb/d. Most of the demand growth in this region is being met by Middle East producers. The Middle East accounted for 44 per cent of China's, 66 per cent of India's, and 75 per cent of Japan's import requirements. In 2012, more than 75 per cent of Middle East exports were destined for the Asia Pacific region. Given that oil is expected to continue to flow from the Middle East towards the east, the securig of trade routes is of central importance for Asian players. A key issue is whether Asian players would take more responsibility in securing trade routes and try to play a greater role in regional security. Given the current status of China's and India's navies, however, it will take decades before such a geopolitical shift takes place. Thus, for the foreseeable future, the USA will continue to play a key role in the protection of oil trade routes.

In short, the US energy boom, on its own, is unlikely to be a real game changer for US foreign policy. Nevertheless, it could reinforce current trends – particularly the pivot towards Asia[66] and the reduction in US military presence in the Gulf in the age of austerity. However, there is always the risk that perceiving the Middle East to be no longer central to oil market stability could induce some radical foreign policy shifts, with detrimental effects on an already unstable and highly fragile region.

5. Conclusions

US tight oil growth has produced a powerful supply shock, ensuring significant shifts in the trade flows of crude oil, petroleum products, LPG, and condensates. These shifts have resulted in a more competitive environment which will intensify further as US net imports continue to fall, with wide implications on global oil markets. At the same time, many GCC countries are also trying to capture value added through extending the value chain. The US supply shock has also shifted market perception from scarcity to abundance and has changed the USA's view about the geopolitical relevance of the GCC.

Despite these transformations in the global oil scene, the Middle East more generally – and the GCC more specifically – will remain a central feature of the oil market. With the share of oil in global primary energy demand expected to hold at close to 30 per cent through until 2035, the call on Middle East and GCC oil will continue to increase. Therefore, the investment policies in these countries will remain key to future oil balances. In the shorter term, many of the supply shocks and their offsets originate from the region. The US supply shock has helped put a ceiling on the oil price and under some circumstances could result in a softer market. But the view that the US oil shock could erode the revenue base of the GCC, and consequently destabilize it, is rather simplistic. The supply shock from the USA on its own is unable to move the market to a persistently low oil price environment. But, more importantly, it is in these softer markets that the output policies of some GCC producers would have the most significance.

Rather than external factors, some of the internal dynamics could prove capable of playing a much bigger role in the future position of the GCC within the global energy order. One of the disturbing trends in the region over the last two decades has been the faster growth of regional oil consumption in comparison to its production.[67] While factors such as robust economic and population growth, improvements in living standards, and energy intensive industrialization have all contributed to growth in energy demand, a big part of the demand growth can be attributed to wasteful consumer behaviour and inefficiency in the use of energy due to low energy prices. Political turmoil and fear of regional spillovers have reinforced pre-existing barriers to reforming the region's domestic energy markets (including energy prices), and such reform is needed to put a dent in domestic energy demand growth. On the supply side, low domestic prices, unattractive fiscal terms, erosion of the technological and human capability of NOCs, and a deteriorating investment environment in some parts of the region imply that supply growth is likely to be constrained in many parts of the region. This is happening at a time when countries, including those unaffected by the immediate repercussions of the Arab Uprisings, have responded to the upsurge in political turmoil across the region by increasing their social spending, which means

that Middle East oil exporters have become even more dependent on high oil prices and hydrocarbon revenues, increasing their vulnerability to cyclical movements in the oil price. Rather than changes in the US energy scene, domestic factors in the shape of oil producers' lack of success in diversifying their economies and their revenue base, together with inefficient energy policies, could prove to be the region's biggest threat.

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[1] See for instance, 'Drowning in Oil', *The Economist*, 4 March, 1999.

[2] See for instance, 'ENERGY 2020: North America, the New Middle East?', Citi GPS: Global Perspectives & Solutions, March 2012; IEA, Medium-Term Oil Market Report (MTOMR), May 2013; 'ENERGY 2020: Independence Day', Citi GPS: Global Perspectives & Solutions, February 2013.

[3] Paul Stevens, 'The world might be drifting into an oil price shock', *Financial Times*, 25 July 2013.

[4] Naím, M. (2014), 'Shale gas revolution reshaping international relations', *Oil*, 17 January.

[5] Similar questions were raised following Russia's increase in its oil production in the 2000s. At that time, Morse and Richards (2002) argued that the 'contest for energy dominance between the world's two largest oil exporters, Saudi Arabia and Russia… will have fundamental consequences for the world's economy, U.S. energy security, Russia's global role, the future relevance of Saudi Arabia, and the clout of the Organization of Petroleum Exporting Countries (OPEC)'. Morse, E and J. Richards (2002), 'The Battle for Energy Dominance', *Foreign Affairs*, March/April issue.

[6] See for instance, Allsopp, C. and B. Fattouh (2012), 'Oil and International Energy', *Oxford Review of Economic Policy*, 27(1): 1–32, 2011.

[7] 'Concentration of U.S. crude oil imports among top five suppliers highest since 1997', *Today in Energy*, EIA, 19 April, 2013.

[8] 'AEO2014 Early Release Overview', EIA, December 2013.

[9] 'Growth slows in U.S. ethanol production and consumption', *Today in Energy*, EIA, 14 September 2011.

[10] BP (2014), BP Statistical Review of World Energy 2014.

[11] For more details, see Fattouh, B. and A. Sen (2014), 'New Swings for West African Crude', Oxford Energy Comment, August.

[12] Based on an analysis of 26 energy companies with refinery operations that submit financial and operating information by segment to the US Securities and Exchange Commission (SEC), the EIA estimates that in the first three months of 2014, North American refiners' earnings per barrel processed were more than $6 per barrel higher than those of their European counterparts. See 'Lower crude feedstock costs contribute to North American refinery profitability', *Today in Energy*, EIA, 5 June 2014.

[13] US refineries have been processing record volumes of oil, hitting a record high 16.8 mb/d in July 2014 which exceeds the previous record from summer 2005. In addition to access to discounted crude and expansion of refining capacity, increases in both domestic demand and exports contributed to the higher refinery runs. See 'U.S. petroleum refineries running at record levels', *Today in Energy*, EIA, 24 July 2014.

[14] See EIA (2014), 'Recent improvements in petroleum trade balance mitigate U.S. trade deficit', *Today in Energy*, 21 July.

[15] See for instance, Sandrea, I. (2014), 'US shale gas and tight oil industry performance: challenges and opportunities', Oxford Energy Comment, March.

[16] See also Kemp (2014), 'Free cash flow says little about the future of shale', *Reuters*, 28 August.

[17] Crooks, E. (2014), 'Shale oil and gas producers' finances lift growth hopes', *Financial Times*, 27 August.

[18] See 'Growth in U.S. hydrocarbon production from shale resources driven by drilling efficiency', *Today in Energy*, EIA, 11 March 2014. The EIA notes that each drilling rig in the Eagle Ford Shale will contribute over 400 b/d more in April 2014 than it would have in the same formation in January 2007.

[19] See Kemp (2014), 'Why the shale revolution is not about to end', *Reuters*, 29 August.

[20] In fact, price volatility in 2013 was at its lowest level over the 2006–13 period, despite the many shocks that hit the oil market that year. See 'Brent crude oil trading range in 2013 was narrowest since 2006', *Today in Energy*, EIA 4 March 2014.

[21] See for instance, Sen, A. 'US Tight Oils – prospects and implications', OIES WPM 51.

[22] El-Katiri, L., B. Fattouh, and R. Mallinson, (2014), 'The Arab Uprisings and MENA Political Instability – Implications for Oil & Gas Markets', OIES MEP 8.

[23] Sandrea, I. (2014), 'US shale gas and tight oil industry performance: challenges and opportunities', Oxford Energy Comment, March.

[24] For instance, *The Economist* reports that the oil price at which shale producers break even ranges from $60 in the Bakken to $80 in Eagle Ford. 'The economics of shale oil: Saudi America', *The Economist*, 15 February 2014. However, it is unclear how these figures are derived and what is included in the cost.

[25] El-Katiri, L., B. Fattouh and R. Mallinson, (2014), 'The Arab Uprisings and MENA Political Instability – Implications for Oil & Gas Markets', OIES MEP 8.

[26] BP (2013), BP Energy Outlook 2030, January.

[27] IEA (2014), World Energy Investment Outlook, Special Report.

[28] For instance, given the importance of Iraq in balancing long-term oil balances, following the recent unrest in Iraq, the back end of the futures curve started to receive bids, pushing the long-term prices upward.

[29] El-Katiri, L., B. Fattouh and R. Mallinson, (2014), The Arab Uprisings and MENA Political Instability – Implications for Oil & Gas Markets, OIES MEP 8.

[30] Aissaoui, Ali (2014), 'MENA Energy Investment Outlook: What We Should Really Worry About', APICORP Economic Commentary, July–August 2014 (link: www.apicorp-arabia.com/Research/Commentaries/2014/Commentary_V09_N7-8_2014.pdf)]

[31] 'Going Global: Predicting the Next Tight Oil Revolution', *Energy and Power Insight*, IHS, September 2013. One such play is in Russia. A number of recent estimates suggest that the resource base to be exploited across Russia is enormous, although highly uncertain. The level of this uncertainty is captured in the wide spread of high and low estimates: total tight oil reserves in Russia have been put in the range of 15 billion to 1.05 trillion barrels. Given that Russia's total proved reserves are estimated at 87 billion barrels it is clear that even numbers at the lower end of the range would be significant additions to the country's oil reserve base. See Henderson, J. (2013), 'Tight Oil Developments in Russia', OIES WPM 52, October.

[32] 'Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States', Analysis & Projections, EIA, June, 2013.

[33] See Henderson, J. (2013), 'Tight Oil Developments in Russia', OIES WPM 52, October.

[34] IEA (2013), World Energy Outlook 2013.

[35] See Robinson, D. (2013), 'US climate change policy and the power sector', OIES EV 61.

[36] Citibank (2013), 'Global Oil Demand Growth – The End Is Nigh', Citi Research Commodities.

[37] EIA (2014), Annual Energy Outlook 2014.

[38] For a detailed discussion in some of these barriers, see Le Fevre (2014), 'The Prospects for Natural Gas as a Transportation Fuel in Europe', OIES NG 84.

[39] Counter intuitively, a lower oil price may not necessarily result in higher instability in the region, as many tend to predict. The last decade of higher oil prices certainly did not enhance the stability of the Middle East, nor did it create a climate that was more conducive to economic reform and diversification.

[40] This trend is expected to continue in 2014 and 2015. See 'Increases in U.S. crude oil production come from light, sweet crude from tight formations', *Today in Energy*, EIA, 6 June 2014.

[41] 'Saudi Arabia Oil Sales to U.S. Imperiled by Shale Boom', *Bloomberg*, 4 September 2014. Unlike other oil exporters, Saudi Arabia has more flexibility in its export policy to the USA. In 2013, to maintain its export volumes above 7 mb/d, Saudi Arabia had to place large volumes of oil in the USA. Any diversion to Asia would have lowered prices in its key market. This export strategy came at a cost, as Saudi Aramco was offering oil to the USA at a significant discount to prices in other regions. Given these losses, it was only a matter of time before Saudi Arabia started diverting its crude into Asia. Saudi Arabian exports to the USA over the last few months fell from 1.57 mb/d in April to 1 mb/d in June. The decline in Saudi exports was partly offset by an increase in Iraqi exports to the USA: just between May and June 2014, Iraqi exports to the USA increased by almost 180,000 b/d. Also, the completion of infrastructure meant that more crude could be transported from Midwest to the US Gulf Coast, putting additional downward pressure on benchmarks in the USGC. However, given that there is still demand for heavy crude by US refineries, the fall in Saudi exports to the USA may prove to be temporary and if prices strengthen, the recent fall in exports to the USA can be reversed.

[42] Recently Kuwait signed a deal with Philippine refiner Petron for 65,000 b/d in 2015 on a delivered (c.i.f.) basis, hoping to increase the term volume to 0.1 mb/d. Kuwait has also signed a 10-year deal with China's Sinopec and will double its exports to the country to 0.3 mb/d next year and then raise volumes to 0.5 mb/d in three years, potentially tied to its 0.3 mb/d Zhanjiang refining JV. The oil will be delivered on a c.i.f. basis, making it more competitive.

[43] 'Kuwait Petroleum eyes stake in Indian refinery, offers crude supply', *Reuters*, 4 September 2014.

[44] Saudi Arabia cut Arab Light October OSPs to Asia and the Mediterranean sharply yesterday by $1.70 and 95 cents respectively to –0.05 cents and –$3.20. These would constitute the lowest levels since November 2010 – the last time Arab Light OSPs were at a discount to Oman/Dubai assessments.

[45] For more details, see Fattouh, B. and R. Mallinson (2013), 'Refining Dynamics in the GCC and Implications for Trade Flows', Oxford Energy Comment, December.

[46] Ibid.

[47] Ibid.

[48] This section is based on Fattouh, B. (2014), 'The US Shale Revolution and the changes in LPG Trade Dynamics – A Threat to the GCC?', Oxford Energy Comment, July.

[49] The bulk of US LPG exports consist of propane, with butane representing a much smaller proportion of the total. Both are produced by passing natural gas through a gas processing plant and as a byproduct of refining crude oil. Propane produced from natural gas has been the fastest-growing component of overall US LPG supply.

[50] 'U.S. exports of liquefied petroleum gases projected to continue through 2040', *Today in Energy*, EIA, May, 2013.

[51] See for instance, K. Koyama (2013), 'LPG Market under Shale Revolution', IEEJ, August; F. Leija and R.L. Gist (2013), 'Shale gas development altering LPG demand, trade', *Oil & Gas Journal*, 6 March 2013.

[52] However, it is important to note that outside Saudi Arabia, there are limits on how much LPG could be diverted domestically, given the smaller size of the petrochemical sectors in these countries and given that the economics of some of the projects depend on exportation of LPG.

[53] This section is based on Brown, C. and B. Fattouh, (2014), 'US NGLs Production and Steam Cracker Substitution: What will the Spillover Effects be in a Global Petrochemicals Market?, Oxford Energy Comment, September.

[54] EIA data.

[55] Troner, A. (2013), 'Gulf Producers Face Increased Competition in Asia Condensate Markets', *MEES*, 22 November 2013.

[56] Ibid.

[57] See 'As U.S. Begins Crude Exports, It Faces Awkward Rivalry With Iran', *Newsweek*, 28 July 2014, (www.newsweek.com/us-begins-crude-exports-it-faces-awkward-rivalry-iran-261549). Unipec and Zhuhai Zhenrong have agreed to lift 0.27 mb/d and 0.24 mb/d from Iran this year, with part of the increase in Chinese imports this year from Iran relating to condensates. Unipec's 0.27 mb/d deal with Iran includes 66,000 b/d of condensate. Zhuhai Zhenrong has agreed to take 70,000 b/d of condensate over and above the 0.24 mb/d crude deal from September onwards, once Dragon Aromatics returns from maintenance overhaul at the end of Q3 14. So from Q4 14, total condensate imports from Iran will be north of 0.13 mb/d.

[58] Mitsui & Co. and Refiner Cosmo Oil Co. have already bought cargoes of US condensate. Enterprise has also signed a short-term contract with another Japanese trader, Mitsubishi Corp.

[59] See 'Asian Buyers Say Tests May Slow Take-Up of U.S. Export Oil', *Reuters*, 5 September 2014. (www.reuters.com/article/2014/09/05/us-asia-condensate-idUSKBN0H01FT20140905). Two Japanese petrochemical makers – Showa Denko and Asahi Kasei – told Reuters that they do not plan to process the condensate due to 'impurities' that would make it difficult to use as a feedstock at their plants.

[60] Expectations of weaker condensates and naphtha prices, combined with potential strengthening of co-product markets, mean that global producers are likely to remain conservatively cautious of going 'all-in' on ethane-based ethylene production. This 'balancing mechanism' implies that naphtha crackers are likely to maintain a large share in global markets outside the USA. A US government decision to ease bans on the exports of light condensate streams would serve to reinforce our argument, as midstream operators are likely to ramp up exports of lease condensate, ultimately resulting in cheaper naphtha and LPG volumes from Asian splitters.

[61] 'ENERGY 2020: Independence Day', Citi GPS: Global Perspectives & Solutions, February 2013.

[62] The IMF has carried out simulations on the potential impact of a fall in the oil price on the GCC. They considered three downside scenarios, which can range from a decline of around 7 per cent (re-intensification of pressures in the euro area) to 20 per cent (prolonged emerging market slowdown). The simulations indicate that fiscal and external balances are sensitive to oil prices, but show that the buffers that have been built up provide a substantial cushion in the event of a significant decline in prices. See IMF (2013), Annual Meetings of Ministers of Finance and Governors of Central Banks, 'Economic Prospects and Policy Challenges for the GCC Countries', Riyadh, Saudi Arabia, October.

[63] As the House Energy and Commerce Committee Chairman Fred Upton explains: 'We have an opportunity to use our energy as a diplomatic tool; we can take care of our domestic needs and have enough energy left to let our allies buy it from us, rather than being held hostage to unstable regions of the world. That means making sure our current laws are not creating artificial barriers to the market and conducting oversight to ensure increased exports do no harm to American consumers'. See 'Upton Unveils Energy Policy Vision with Pillars of the Architecture of Abundance', Energy and Commerce Committee, 15 July 2014. (https://energycommerce.house.gov/press-release/upton-unveils-energy-policy-vision-pillars-architecture-abundance)

[64] Quoted in Michael T. Klare (2014), 'How did How Did Oil Make a Comeback?', *The Nation*, 4 September 2014.

[65] For instance, some have argued that because the USA is importing less oil it is easier for the Obama administration to impose tougher sanctions on Iran's oil exports (there being less risk that the loss of Iranian barrels would cause a sharp increase in the oil price).

[66] Lower dependency on imported oil has not been the main driver behind the pivot towards Asia. For a long time, strategists in Washington have realized that the USA was over-weighted in the Middle East and under-weighted in Asia–Pacific. The author would like to thank Ali Aissaoui for this point.

[67] In a recent article, Prince Abdulaziz Bin Salman Al-Saud argues that 'Although this growth in demand is partially attributed to the industrial growth and growing economic prosperity in the Kingdom, a rather significant portion of it results from the inefficient use of energy; deeming this accelerated growth unsustainable. Whereas the vast majority of countries have managed to lower the energy intensity of their economies, the Kingdom's energy intensity increased significantly over the last two decades. Hence, it is a strategic imperative for the Kingdom that energy efficiency becomes a major topic for all decisions related to an increase in demand for fuel and feedstock'. Prince Abdulaziz Bin Salman Al-Saud (2014) 'A brief on Saudi Arabia's Energy Efficiency Program (SEEP)', *Oxford Energy Forum*, August.