

The Adjustments in the Oil Market: Cyclical or Structural?

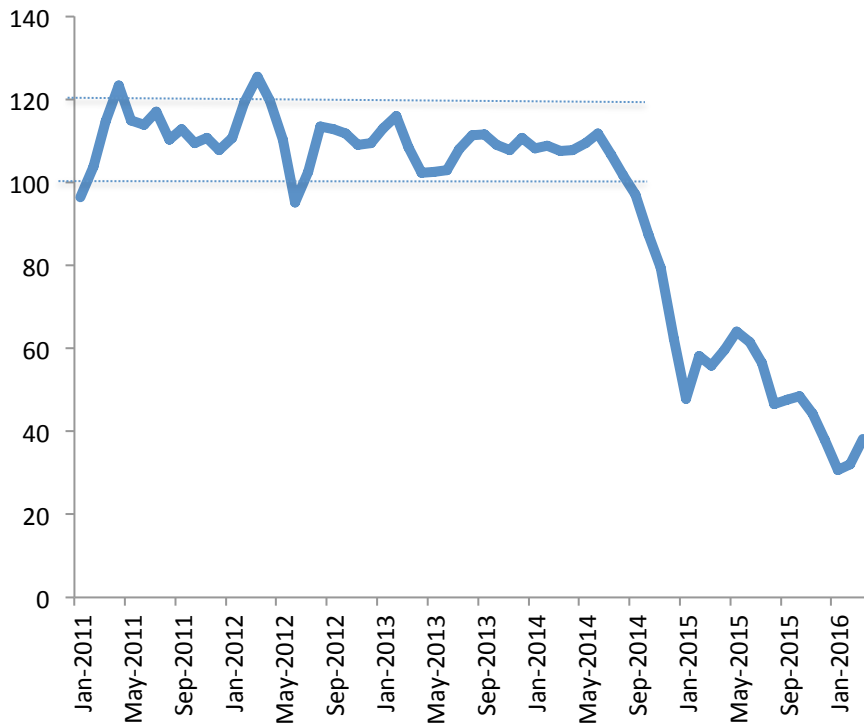
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Oxford Institute for Energy Studies

APRIL 21, 2016, SOUTH AFRICA

After Period of Relative Stability, Oil Price falls Sharply

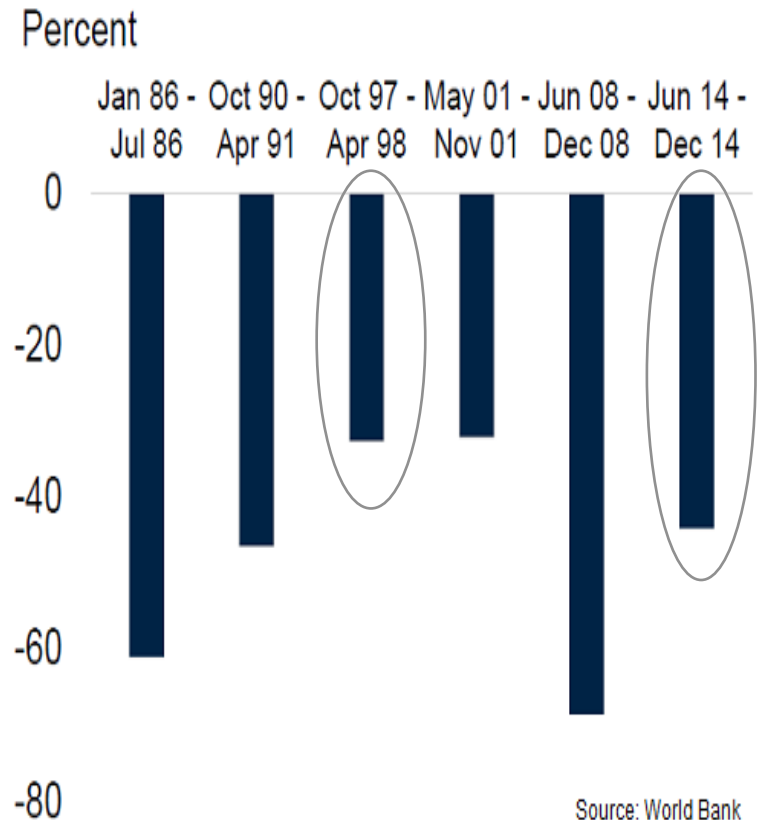
Brent Price, \$/barrel



After trading above \$100 dollars/barrel, the oil price started falling sharply in 2014 and reaching low levels of below \$30 in January this year

Source: EIA, World Bank

Magnitude of significant oil price drops

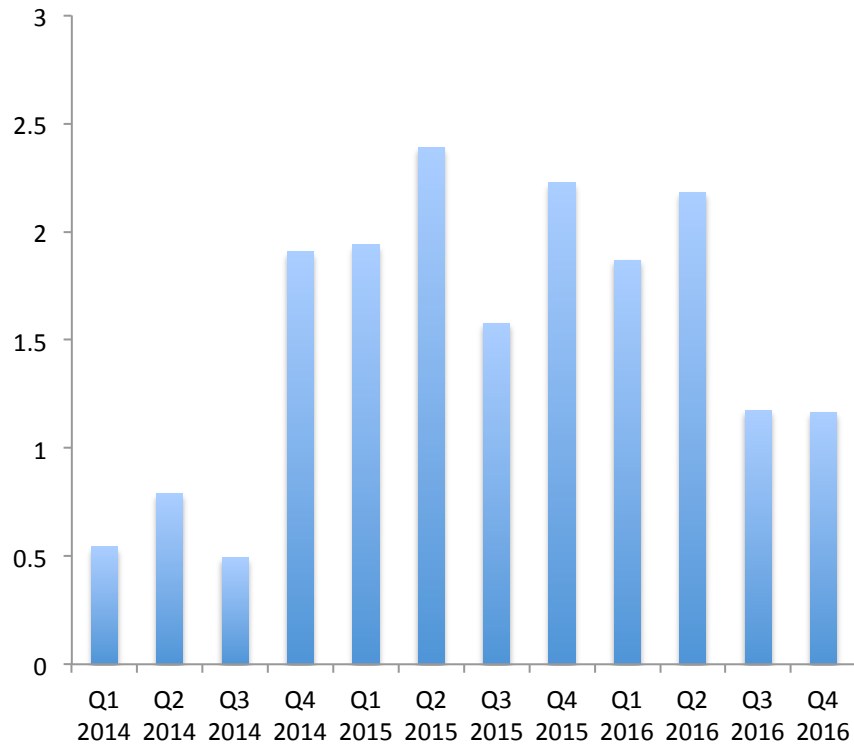


Source: World Bank

The 2014 price fall has been sharp, even when compared to previous episodes of sharp price declines in the 1980s, 1990s and most recently in 2008 following the global financial crisis

Supply-Demand Imbalance and Rising Stocks

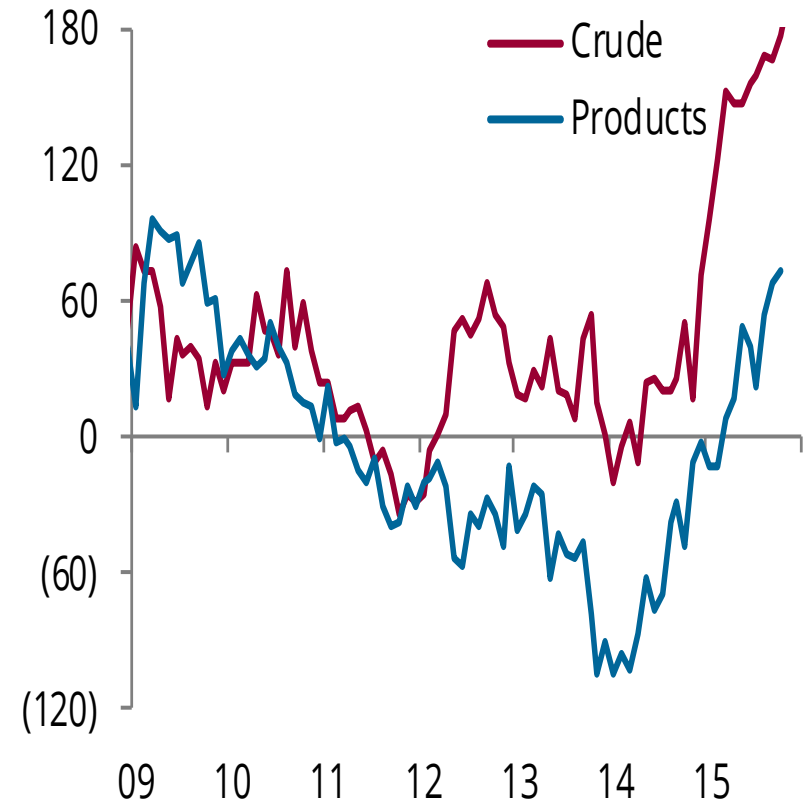
EIA Estimates of Implied Stock Change, mb/d



Since 2014, global supplies have been exceeding global consumption and the world has been adding stocks every month with international organizations expecting this to continue for the rest of 2016

Source: EIA, Energy Aspects

OECD overhang relative to 5yr avg., mb



Crude stocks currently well above the 5-year average; products stocks are also above the 5-year average mainly due to increase in diesel stocks (and more recently gasoline)

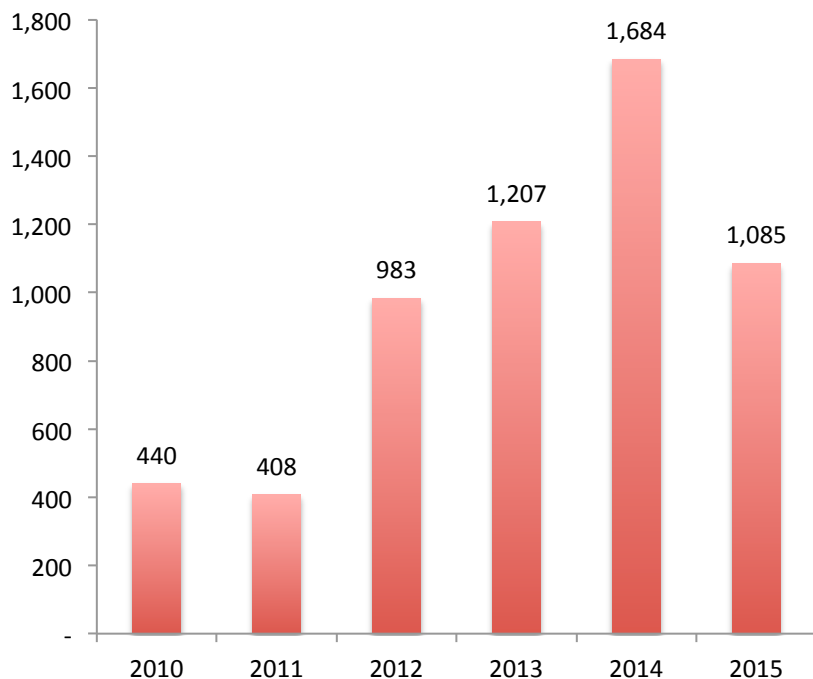
Is this Cycle Different?

- At the start of the cycle, wide belief of relatively fast rebalancing and rapid price recovery based on:
 - Non-OPEC supply falling sharply especially in the US (assumptions: US shale most responsive and most fragile part of the supply curve)
 - OPEC cutting supplies to stabilize the market
 - Low oil prices induces a positive shock to the world economy and generate strong demand responses to help absorb the surplus (though with a lag)
- Why did not expectations of faster adjustment materialize? Has there been a fundamental shift in the adjustment process? Is it different this time round?
- Key to answering the question of whether we have entered a world of 'low oil price for much longer' / a 'new global oil order' or 'oil prices rising sooner than later'
- Wide macroeconomic implications

The Non-OPEC Investment/Supply Response in a Low Price Environment

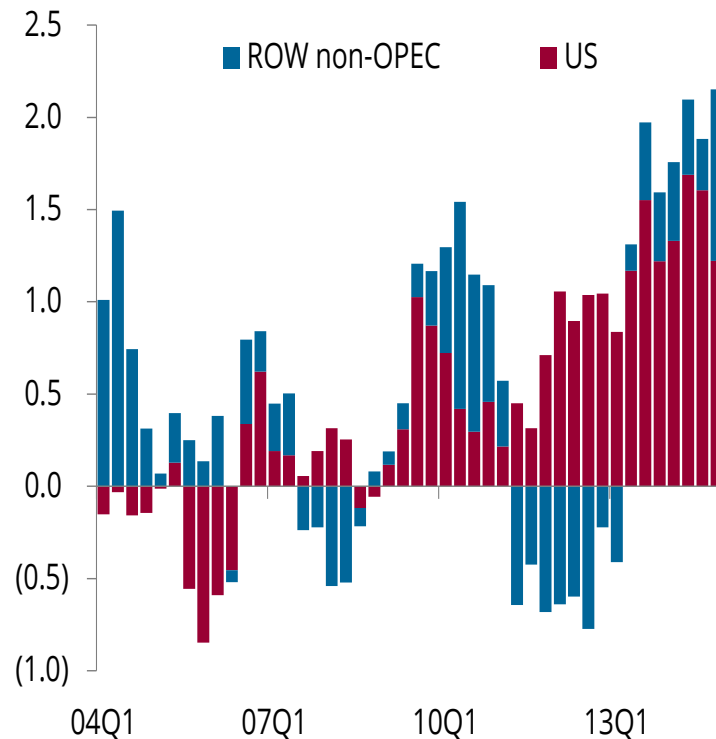
The High Oil Price Environment Generated Strong Supply Responses

Y/Y change in US Liquid Supply (Crude and NGLs), kbd



Shale transformed the oil supply prospects for the US constituting a key supply shock to the rest of the world

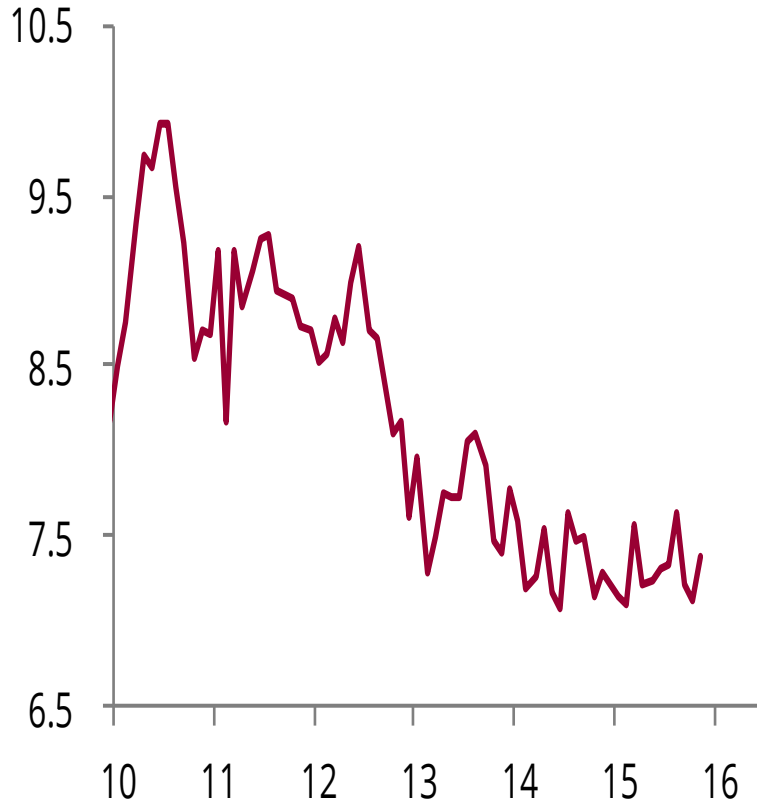
Y/Y Change in Non-OPEC (EX-US) Oil Supply, mb/d



After few quarters of negative y/y growth, non-OPEC supply outside the US rebounded benefitting from record investments due to the high oil price environment

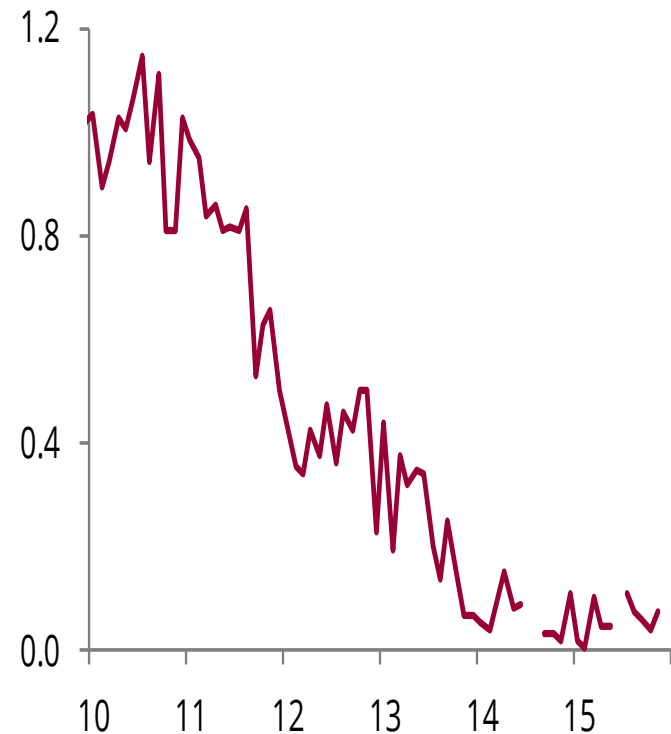
Fundamental Shifts in Trade Flows

Total US Crude Oil Imports, mbd



US crude oil imports fell to below 7.5 mb/d helping the US improve its trade balance

US Crude Oil Imports from Nigeria, mbd



Some of the traditional exporters to the US shut from the US market forcing them to divert exports and compete in other markets (mainly Asia)

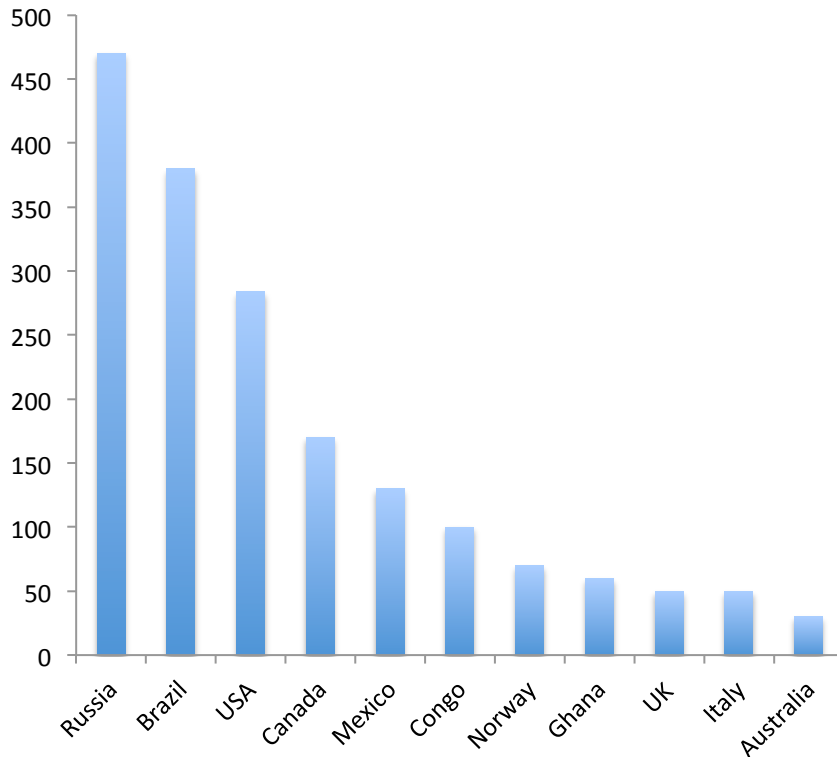
Deep Cuts in Capex in Response to Fall in Oil Price

Global Capex estimates, \$ billion

Region	2016E	2015E	2014A	+ / -	%
United States	72.2	114.6	158.1	(42.3)	(36.9%)
<i>US Independents Intn.</i>	8.5	13.6	21.0	(5.1)	(37.5%)
Canada	22.4	30.1	36.8	(7.7)	(25.5%)
Mexico	14.5	18.0	24.6	(3.5)	(19.4%)
Asia Pacific	78.7	96.2	116.9	(17.5)	(18.2%)
Majors International	77.3	95.7	107.5	(18.4)	(19.3%)
Russia/FSU	37.9	33.2	43.9	4.6	13.9%
Latin America	35.7	47.8	53.2	(12.1)	(25.3%)
Europe	27.6	34.5	45.1	(6.9)	(19.9%)
Middle East	37.0	39.9	40.7	(2.9)	(7.3%)
Africa	16.5	20.1	23.0	(3.6)	(17.8%)
Other	8.0	10.7	10.4	(2.7)	(25.0%)
		0.0	0.0	0.0	
International	0.3	0.4	0.5	(0.1)	(15.7%)
Global Capex	436.4	554.4	681.1	(118.0)	(21.3%)

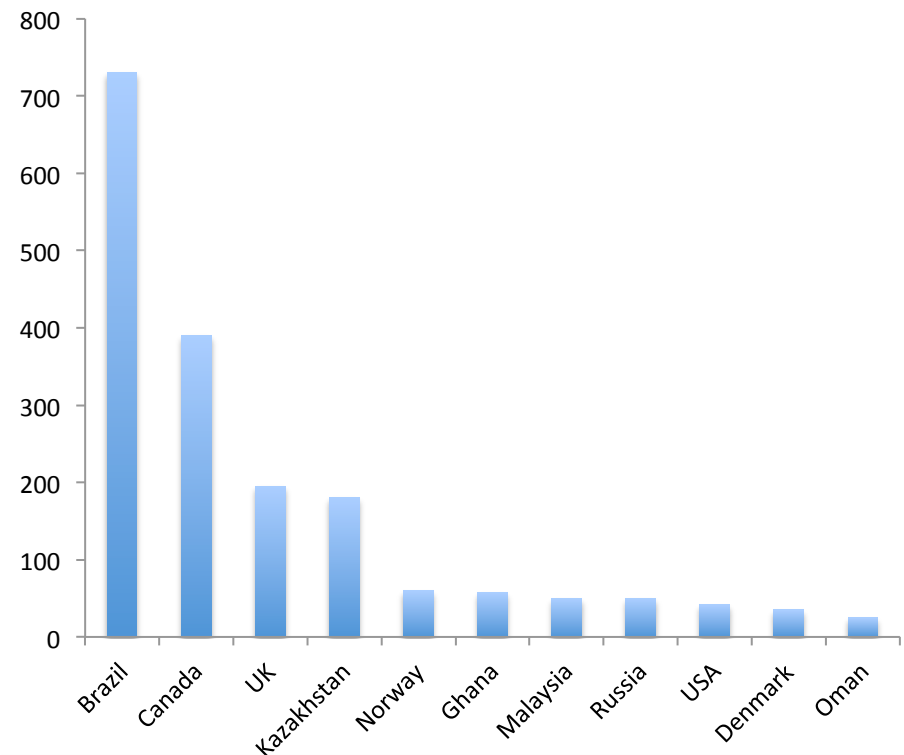
But Many Projects Sanctioned in High Oil Price Environment Coming on-line in 2015, 2016 and 2017

Non-OPEC Upstream Oil Projects Pipeline, kb/d, 2016 (more than 25 kb/d)



More than 2 mb/d of new projects coming online in 2016 sanctioned during the period of \$100 + environment

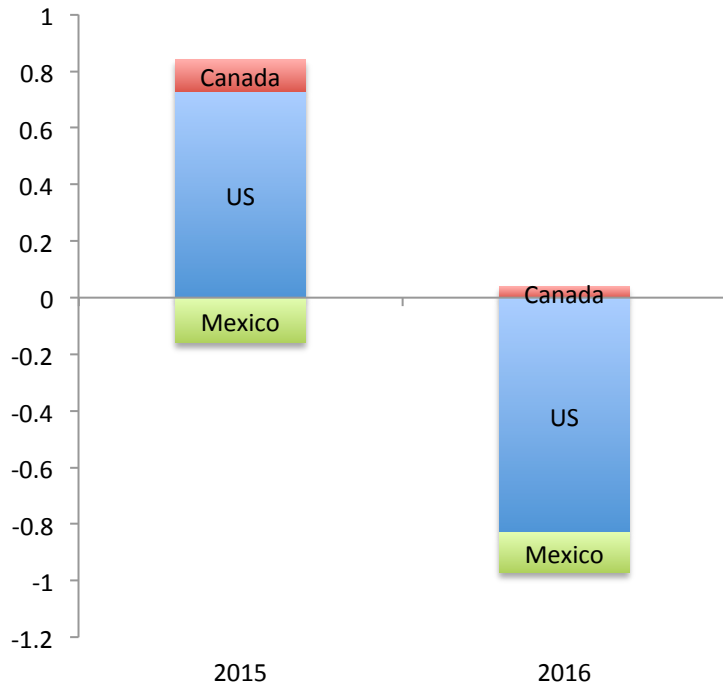
Non-OPEC Upstream Oil Projects Pipeline, kb/d, 2017 (more than 25 kb/d)



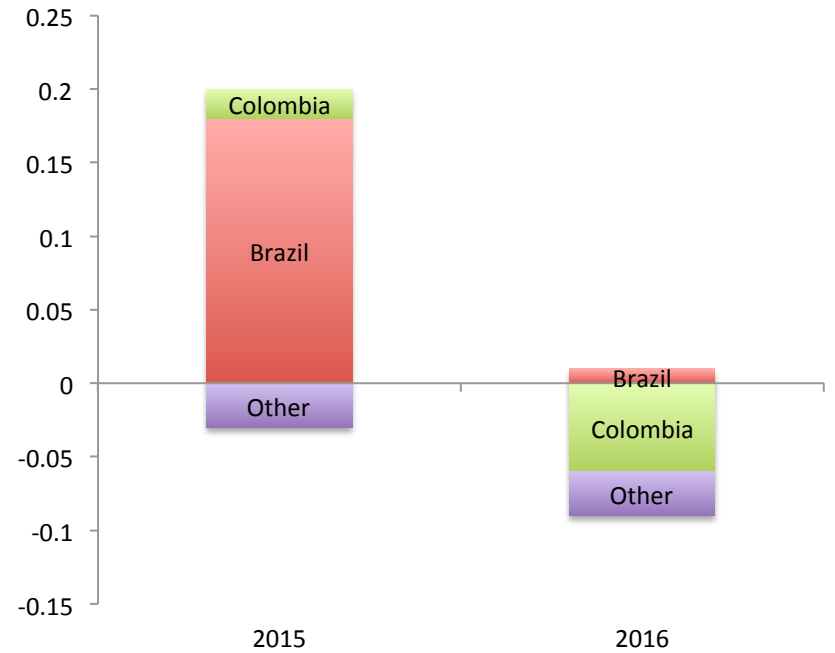
The pipeline of new projects starts slowing down in 2017 but still close to 2 million b/d and will help offset declines in non-OPEC supply

Non-OPEC Supply in Key Areas

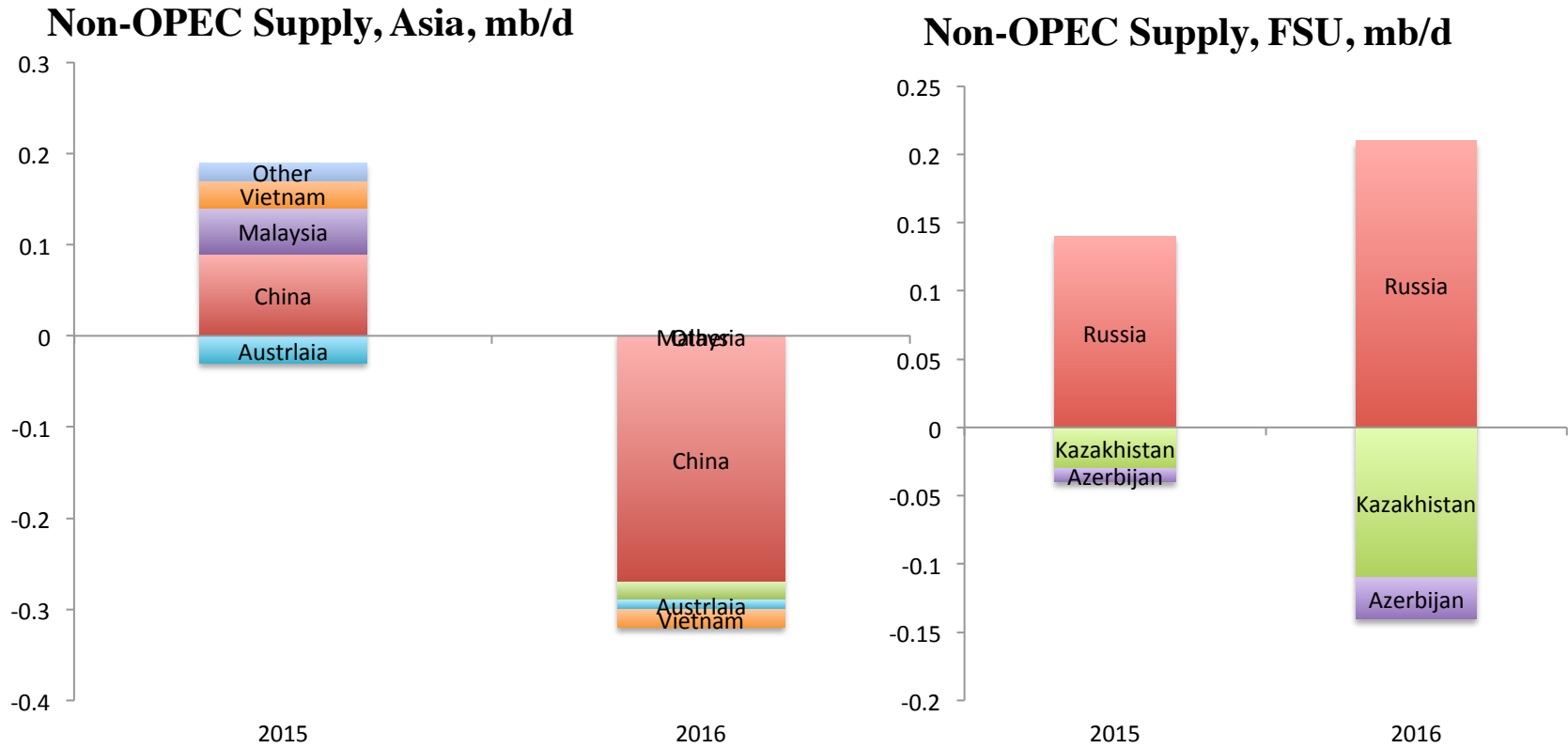
Non-OPEC Supply, North America, mb/d



Non-OPEC Supply, Latin America, mb/d

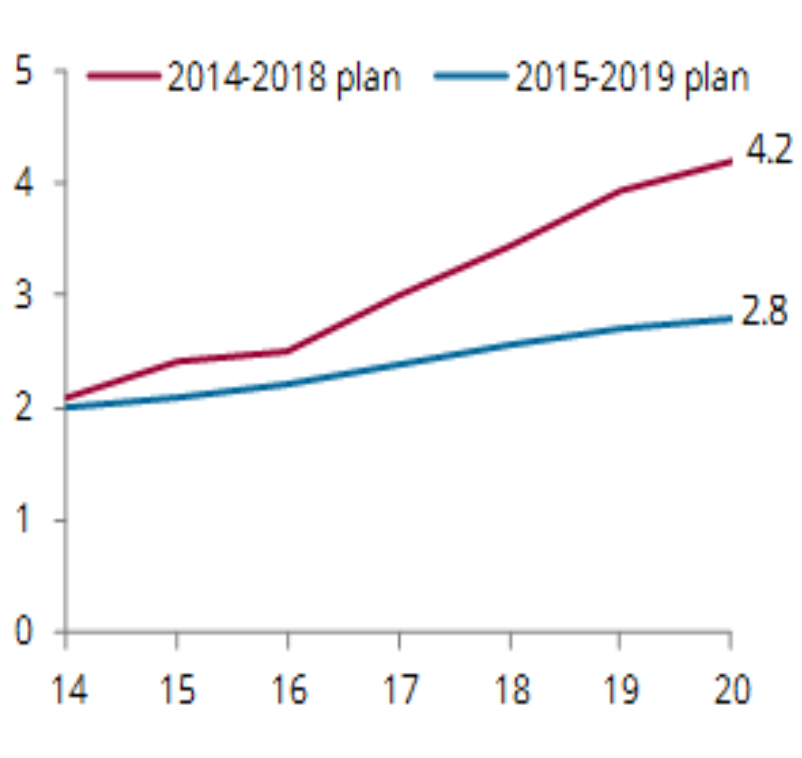


Non-OPEC Supply in Key Areas

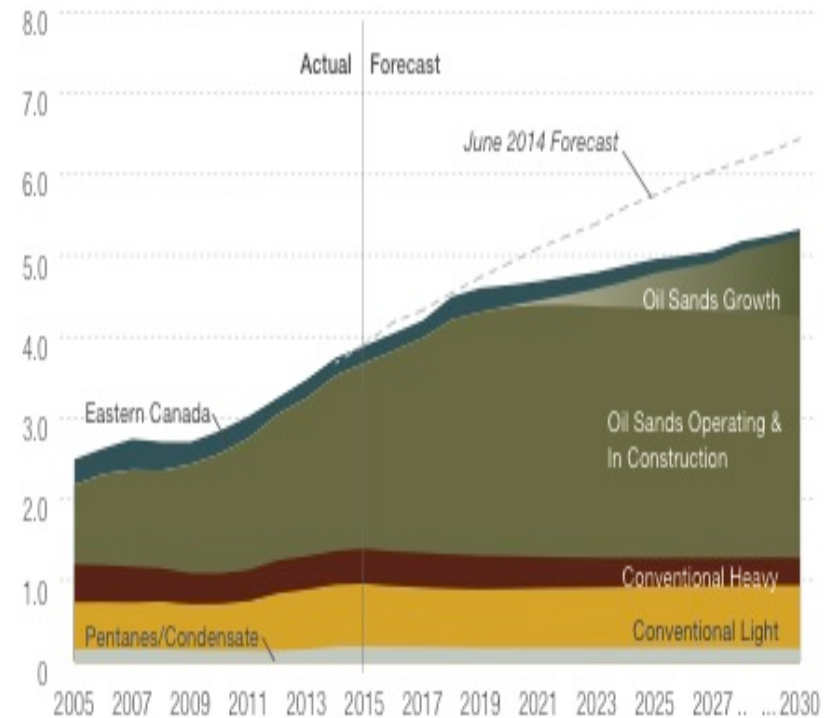


Most of Projections of Supply Growth have Been Revised Downward

Petrobras Production Forecast, mb/d



Canada Production Forecast, mb/d

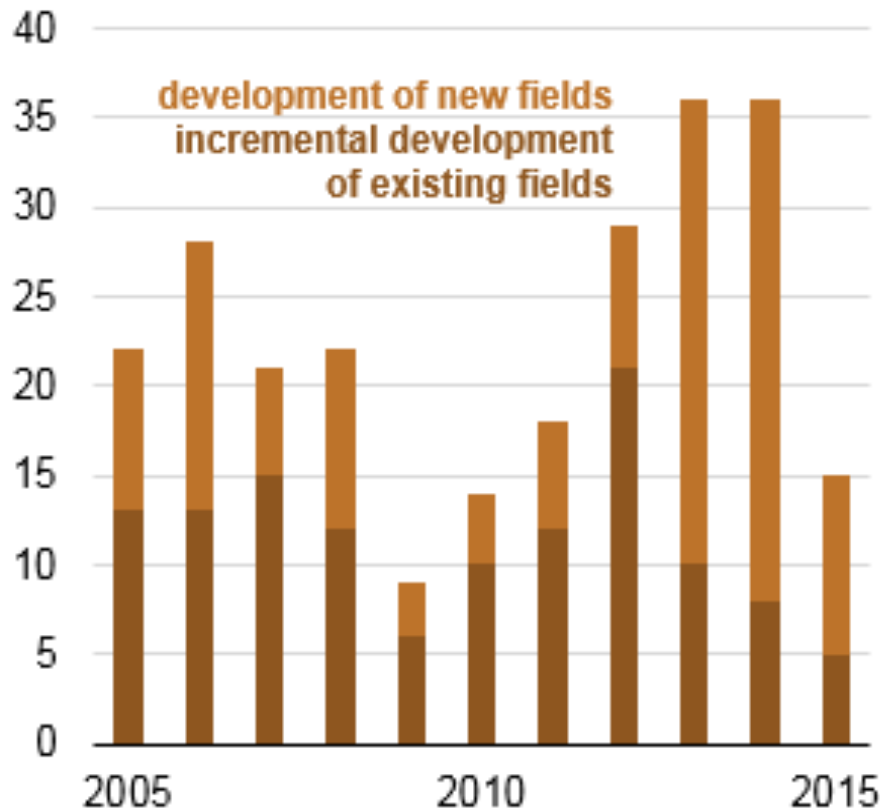


Some of the key growth centers such as Brazil are feeling the pinch. Brazil has already reduced its capex and revised downward its production target to 2.7 mb/d of liquid production by 2020

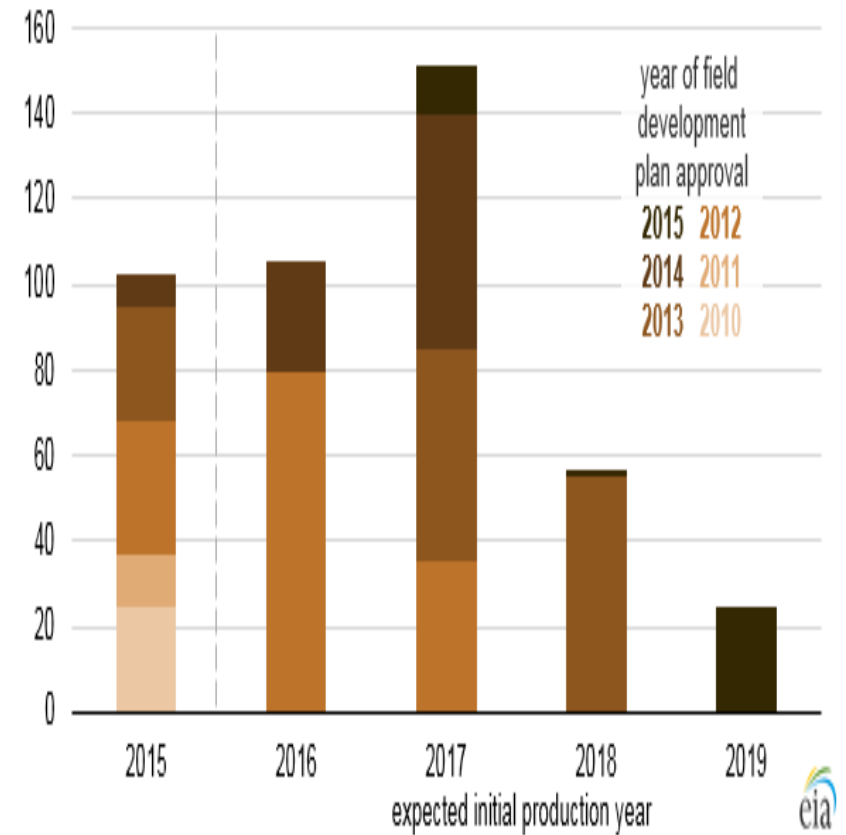
And Canada's oil production has been revised downward substantially as many projects get postponed or cancelled

The North Sea Investment and Output Dynamics

Field development plans approved by U.K. regulators (2005-15)

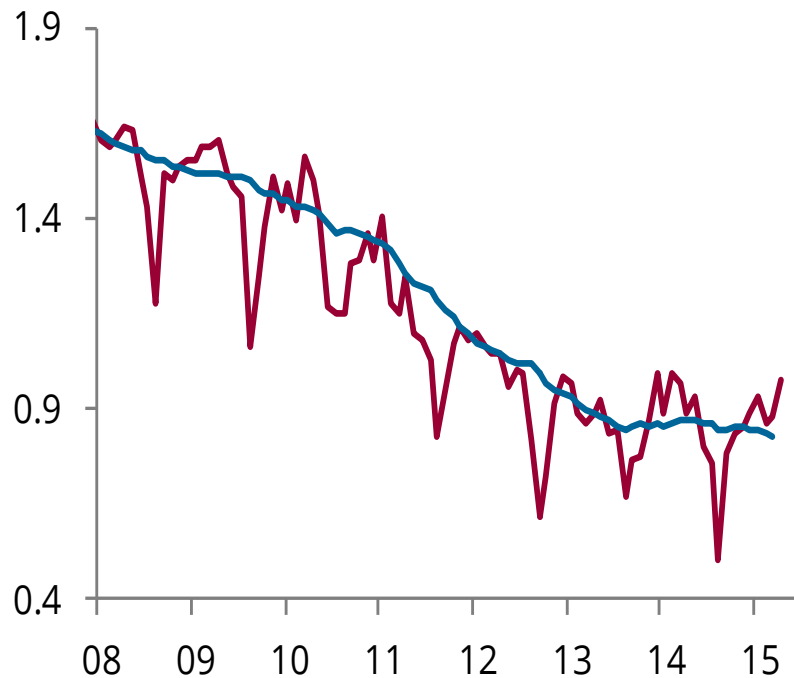


United Kingdom offshore fields' expected peak production volumes thousand barrels per day

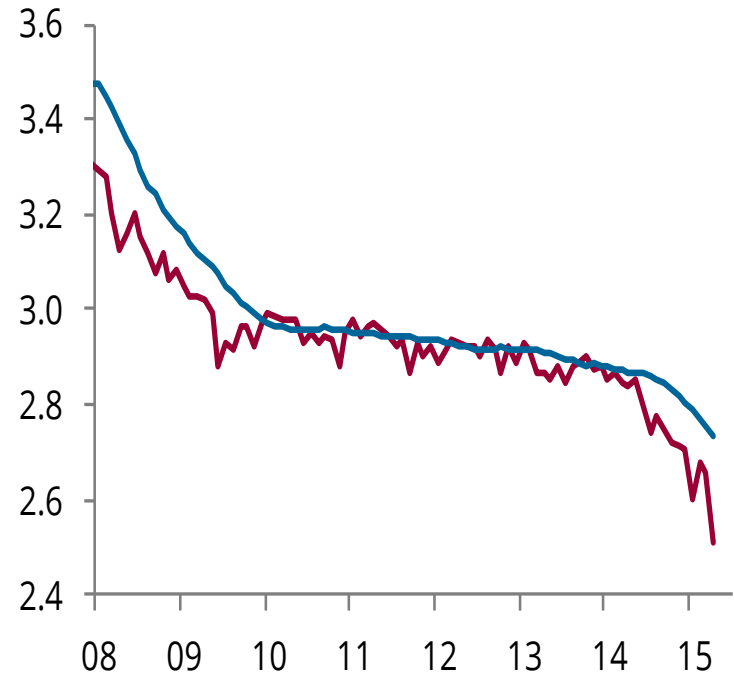


Decline Rates Accelerating in Some Mature Areas

UK Liquid Production, mb/d



Mexico Oil Production, mb/d

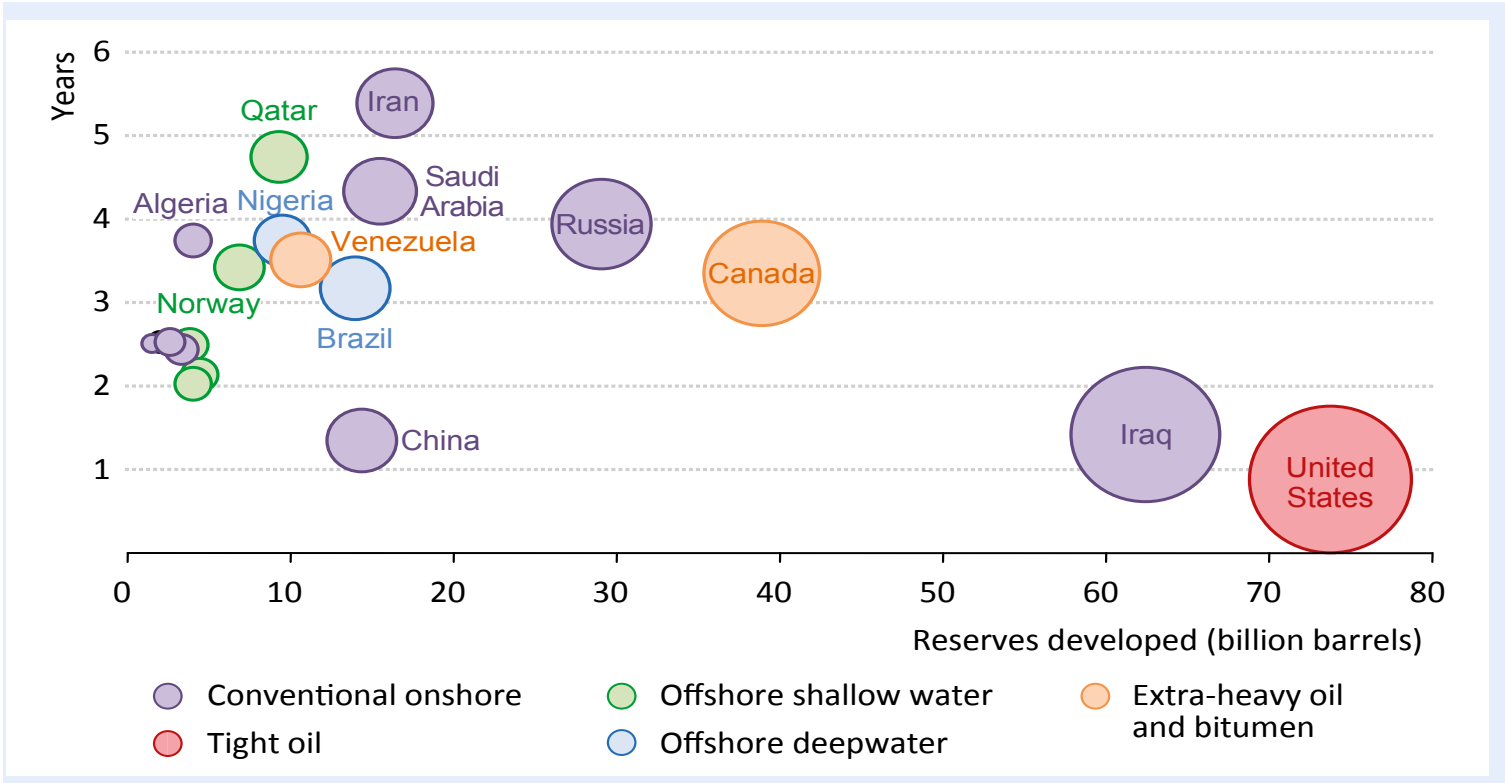


The decline rates in some of the mature areas such as the UK will accelerate in a low price environment as investment in the high oil price environment fades

In Mexico large investments are needed to reverse the heavy declines

The US Shale Supply: A Very Different Investment Cycle

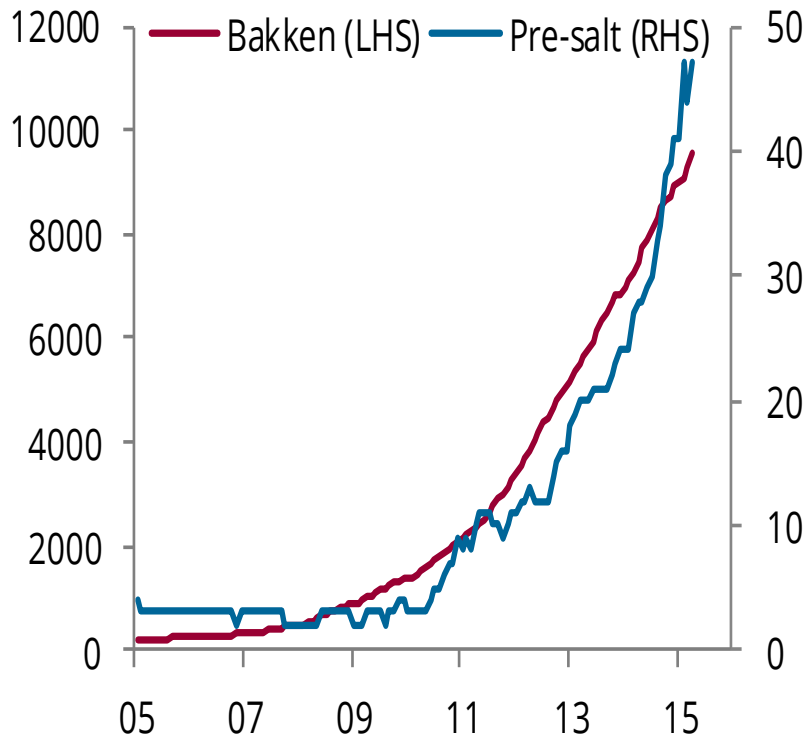
Average lead times between final investment decision and first production for different oil resource types



The investment cycle for US shale is different with the time lag between Final Investment Decision (FID) and first production is a fraction of that for conventional and deep offshore fields

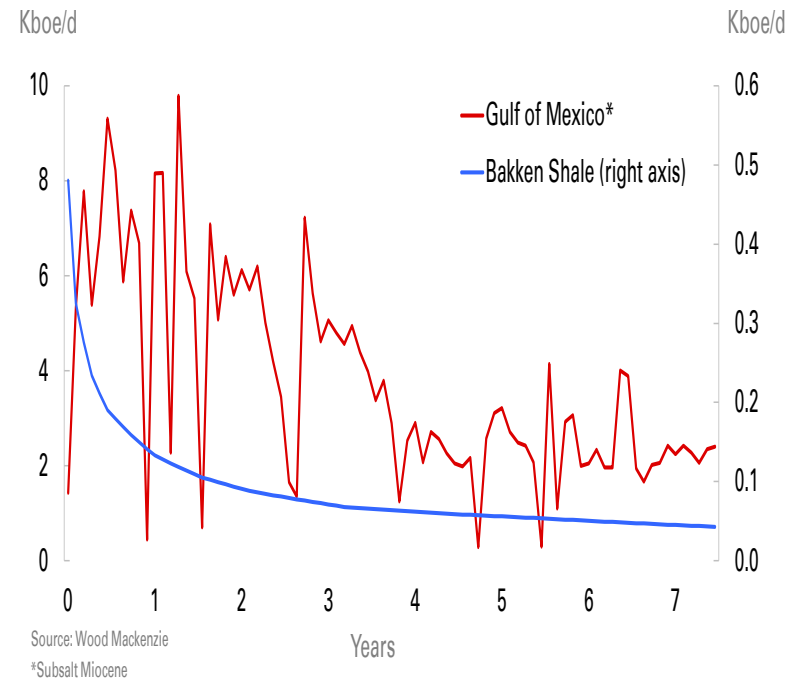
Very Different Profiles of Production and Decline Rates

Bakken vs. pre-salt well count (no of wells)



Sample Well Production Profile

Sample well production profile

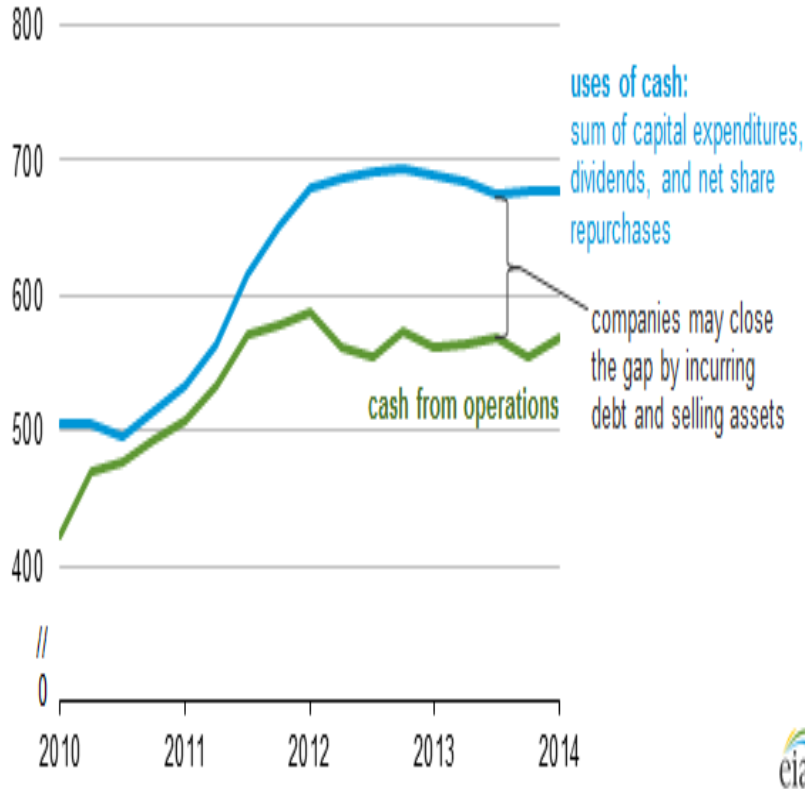


Bakken and pre-salt Brazil achieved similar production growth but the investment profile and the number of wells to achieve that growth fundamentally different

So are the decline rates which are much more prominent in shale wells compared to conventional fields

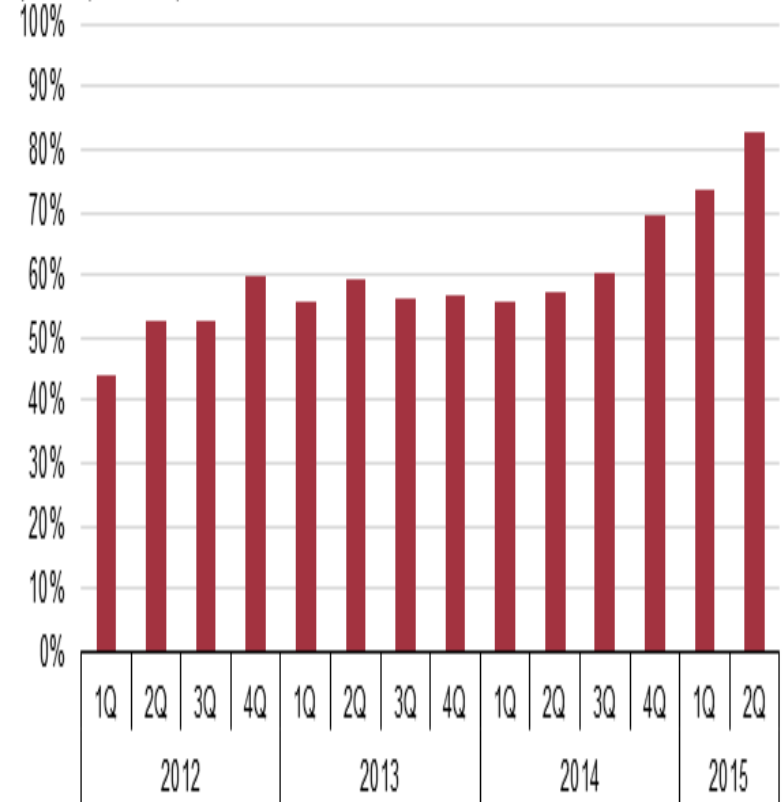
Shocks from Credit Markets Can Impact Production

Major energy companies' cash from operations and uses of cash
billion 2014 dollars, annualized values from quarterly reports



Cash flow from operations have not been large enough to cover to cover capex with the shortfall increasing in recent years.

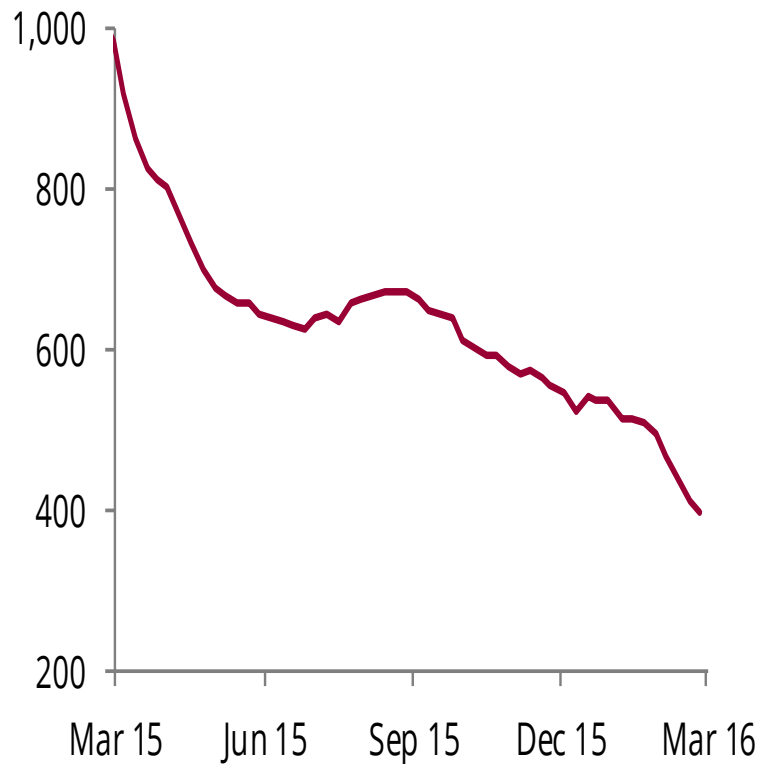
U.S. onshore oil producers' debt service as a share of operating cash flow
percent (annualized)



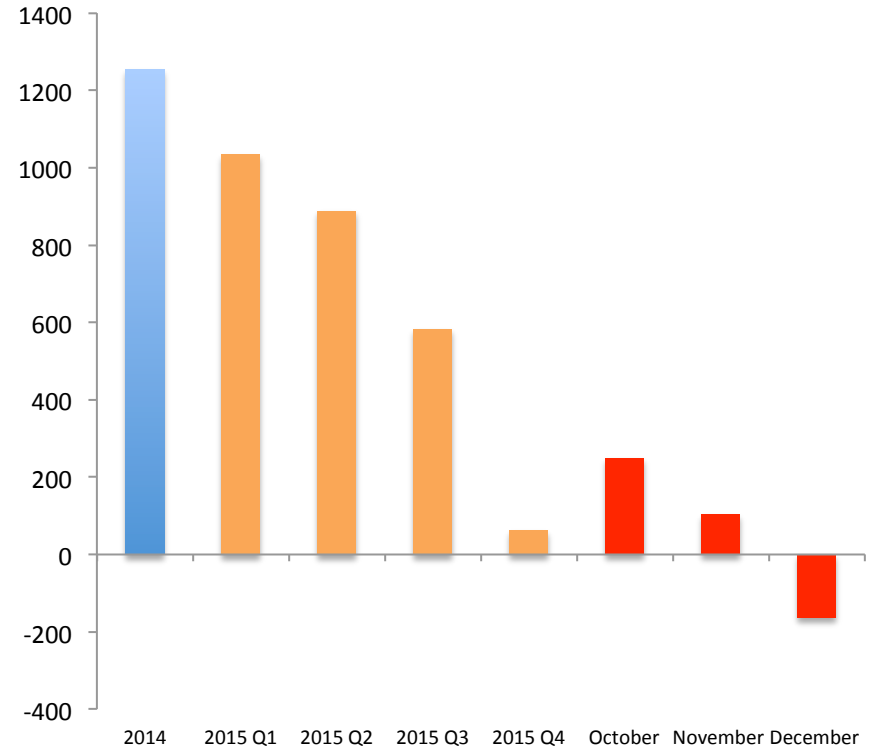
The shortfall has been financed by debt (bank loans, bonds); leverage of US shale producers has risen sharply over the years with debt service as a hare of operating cash flow reaching high levels

US Shale has been the Fastest to Respond on the Supply Side

US Rig Count



US Crude Oil, y/y, kb/d

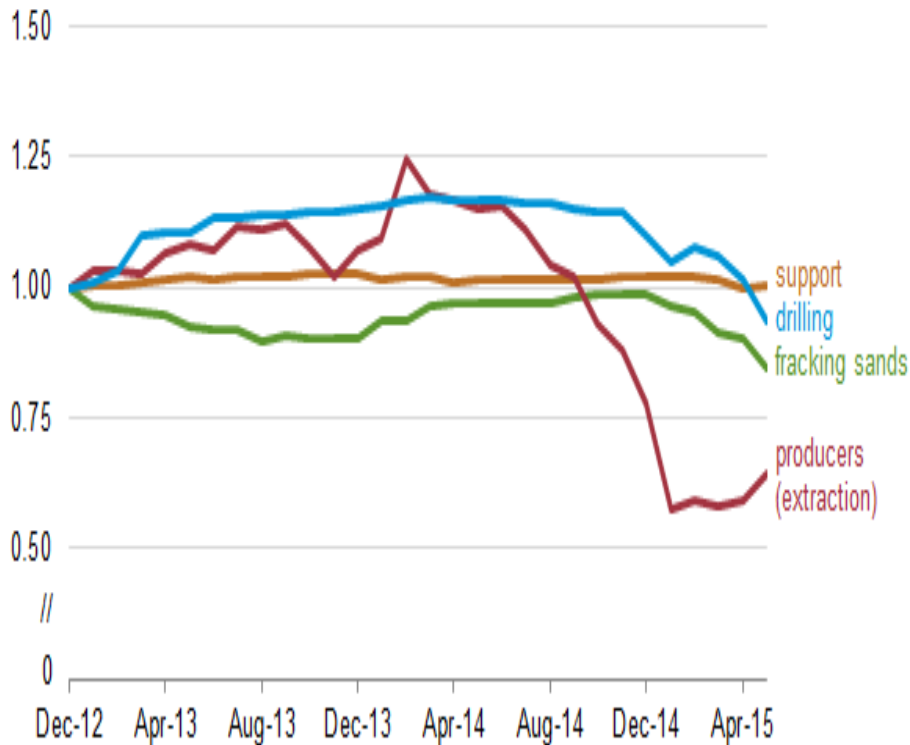


The decline in the rig count in the US has been sharp as US shale producers cut capex and shift strategy from growth maximization to operating within cashflow

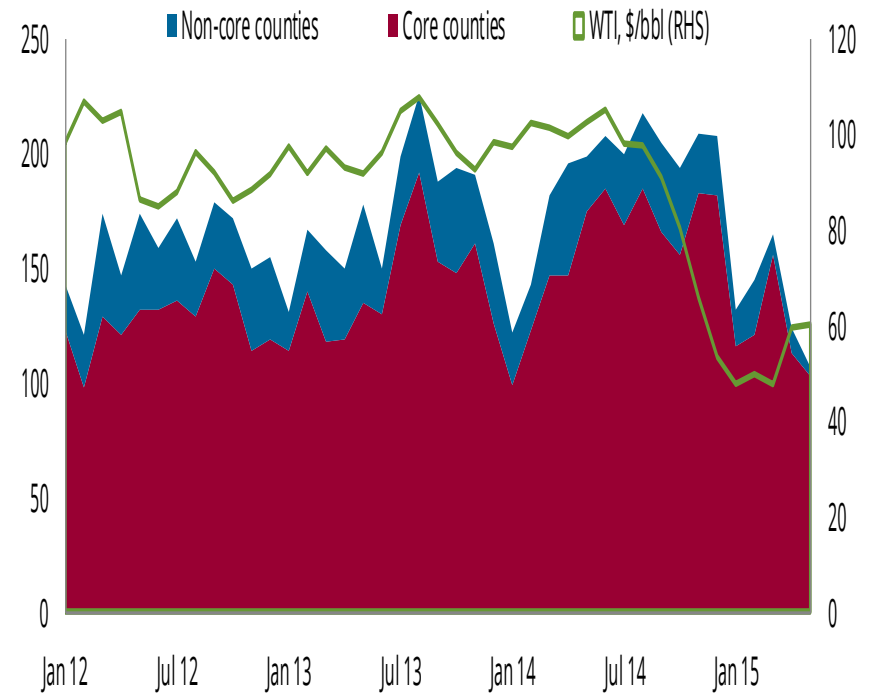
Despite efficiency gains and cutting cost and increase in production from the GOM, y/y growth has been slowing down with the EIA predicting sharp y/y declines in 2016

Efficiency Gains But Also High-Grading, Lower Cost of Services and Hedging

Producer price index for key elements of oil and natural gas industry indexed to December 2012



Monthly Well Completion in North Dakota

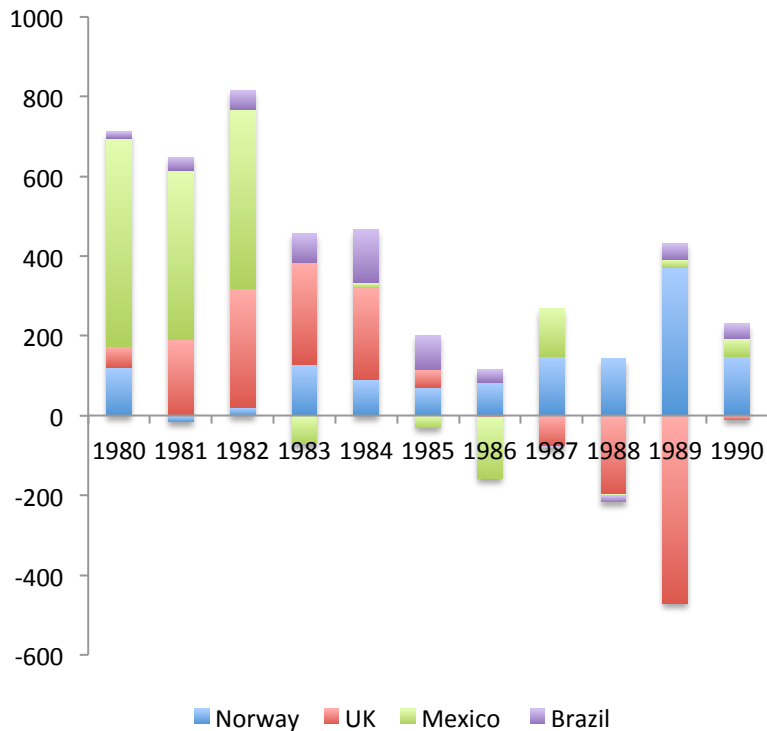


US shale has proven to be more resilient than originally expected with efficiency improvements and lower costs of services bringing down the the break-even cost

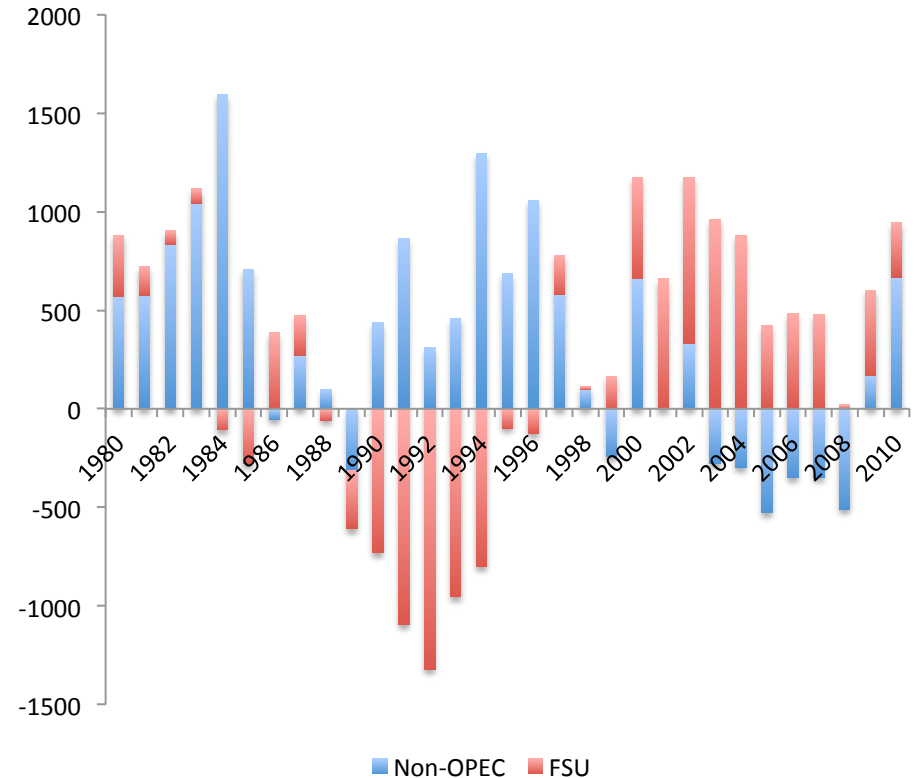
But part of the improvement is also related to high-grading as rigs moved from non-core area to core areas with higher IP

Very Different from the Dynamics of non-OPEC Supply in the 1980s

Oil Production Growth, Selected Countries y/y change, kbd



Oil Production Growth, non-OPEC and FSU y/y change, kbd



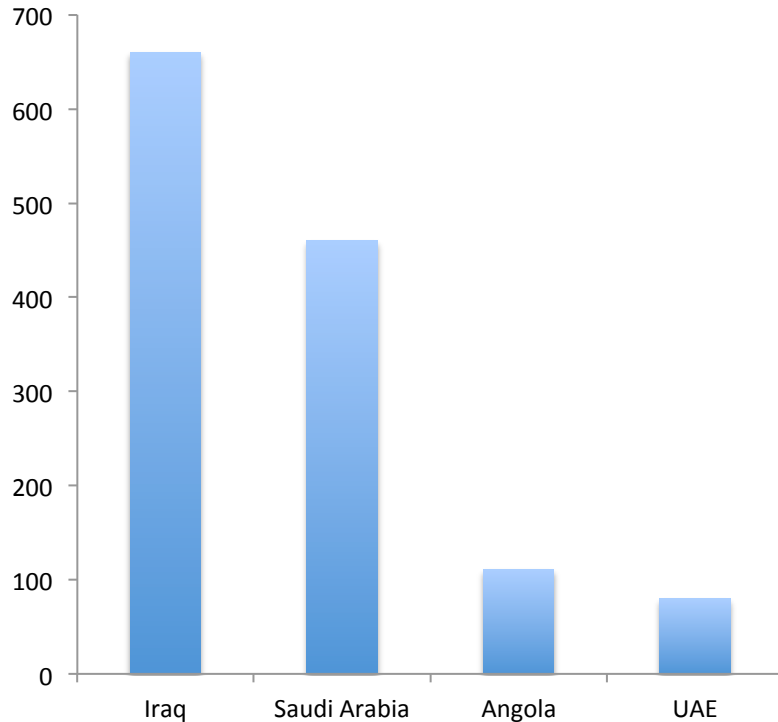
High cost producers such as the North Sea and Mexico with long-term investment cycles led the way but production started slowing down and eventually turned negative in key supply centers

Strong Non-OPEC supply growth preceding price fall in 1986 but the dynamics within non-OPEC shifting

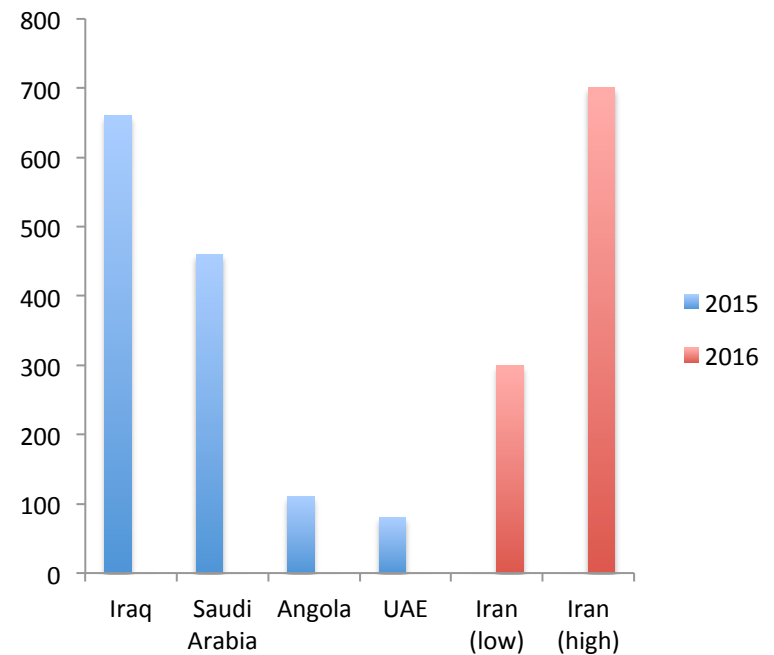
The OPEC (non)Response

OPEC Has Been a Major Source of Supply Growth

Key Areas of Growth in OPEC, y/y kb/d, 2015



Potential Iran oil Output, mb/d

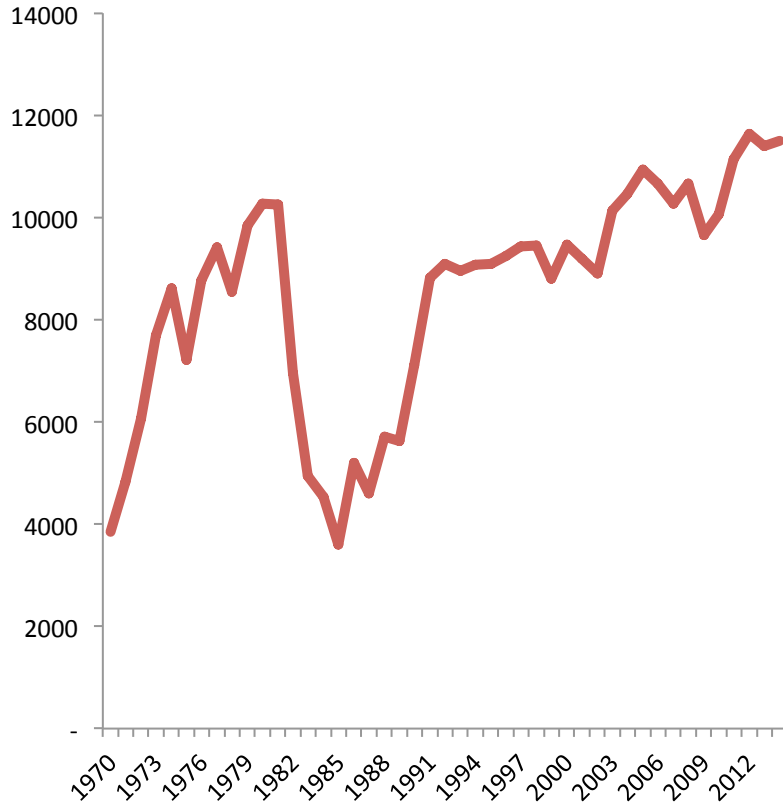


OPEC has been the major source of supply growth in 2015 with Iraq and Saudi Arabia alone adding more than 1.1 mb/d

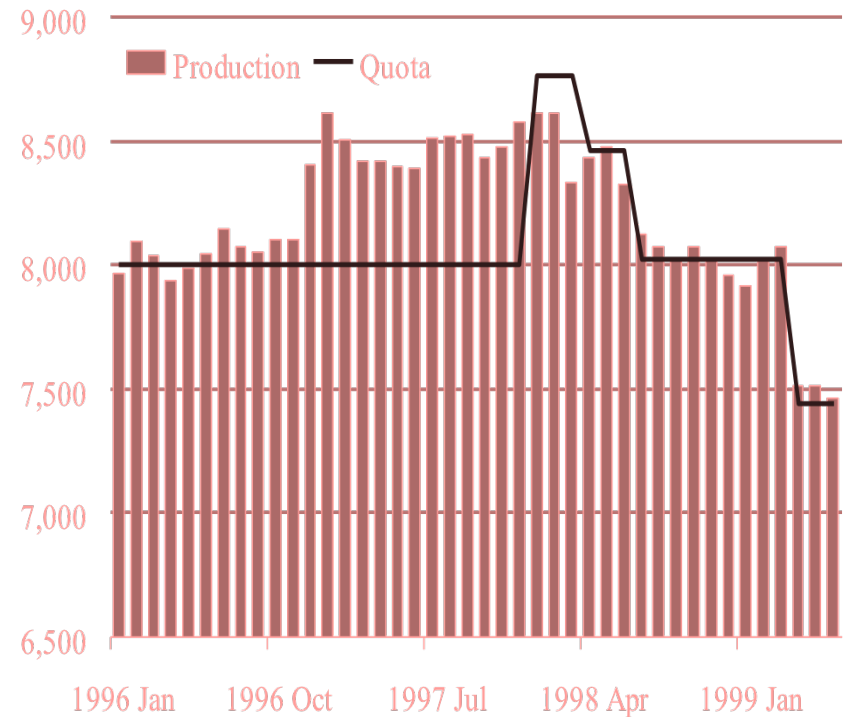
In 2016, Iran and Saudi Arabia constitute the major source of uncertainty on the supply side

Saudi Arabia and the Role of the Swing Producer

Saudi Arabia Oil Production, mb/d



Saudi Arabia production vs Quota (000 b/d)



Saudi Arabia not willing to cut output unilaterally; shaped by the mid 1980s events when its attempt to protect the price resulted in loss of large volumes of production and market share

In 1998, SA reacted by increasing production and did cut output but only after agreement with other OPEC and non-OPEC members has been reached; took long time to forge such an agreement

Bringing Back Iraq and Iran into the Quota System Challenging

Iraq Oil Production, mb/d



In 2015, Iraq, a low cost producer, has been the major source of supply growth adding more than 650,000 b/d

Iran Oil Production, mb/d



How much and how fast can Iran increase its export is a major source of uncertainty facing Saudi Arabia and the wider market

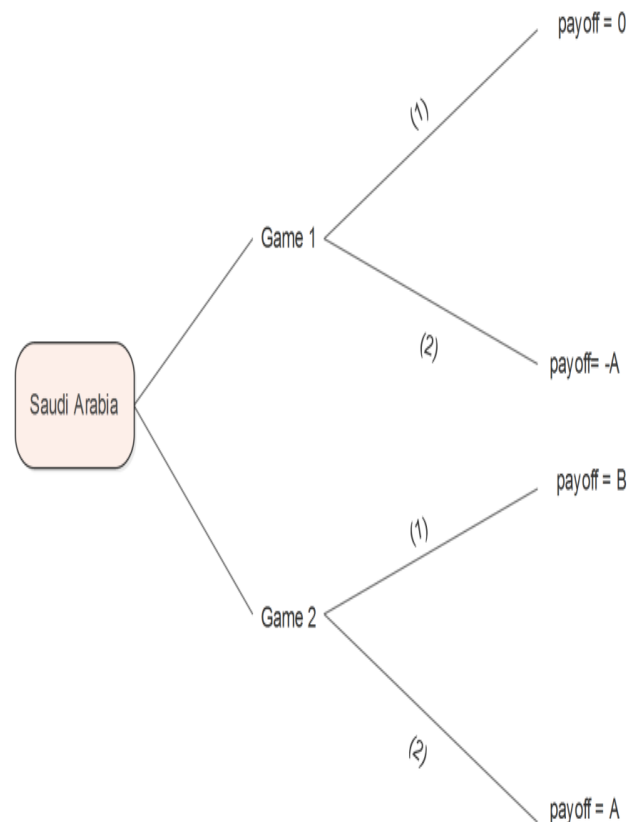
US Shale Supply Response Introduces New Set of Uncertainties

Table 2: Optimum strategy in the short run (falling market)

	Elastic US supply (game 1)		Inelastic US supply (game 2)	
	Other-OPEC members cut output	Other-OPEC members do not change output	Other-OPEC members cut output	Other-OPEC members do not change output
SA cuts output	-C, -C	-A, 0	A, A	C, B
SA does not change output	0, -A	0, 0	B, C	0, 0

Under complete information about shale response in a rising price environment, there is a single and efficient solution to the game

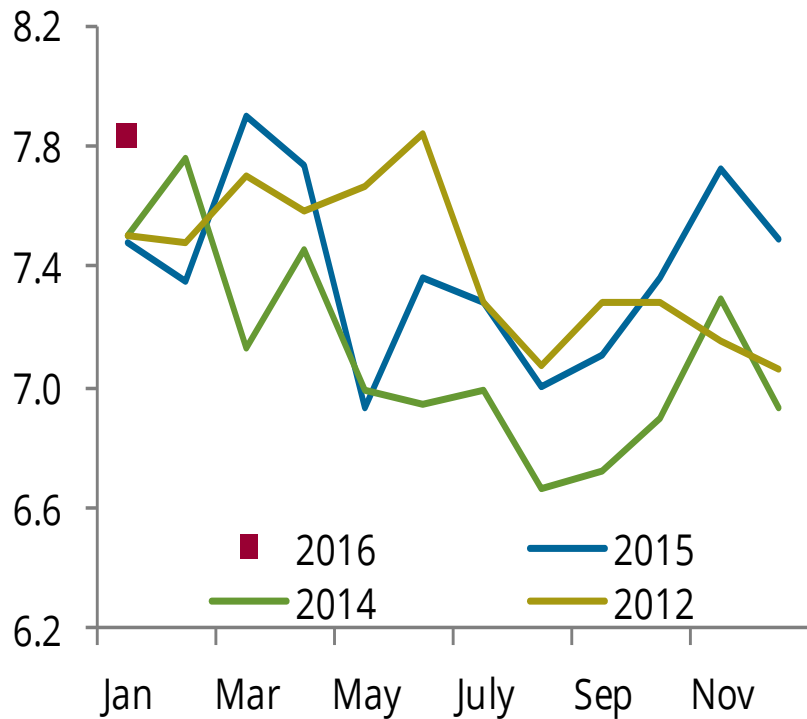
Figure 4: Tree diagram of the whole game in presence of uncertainty induced by US shale oil



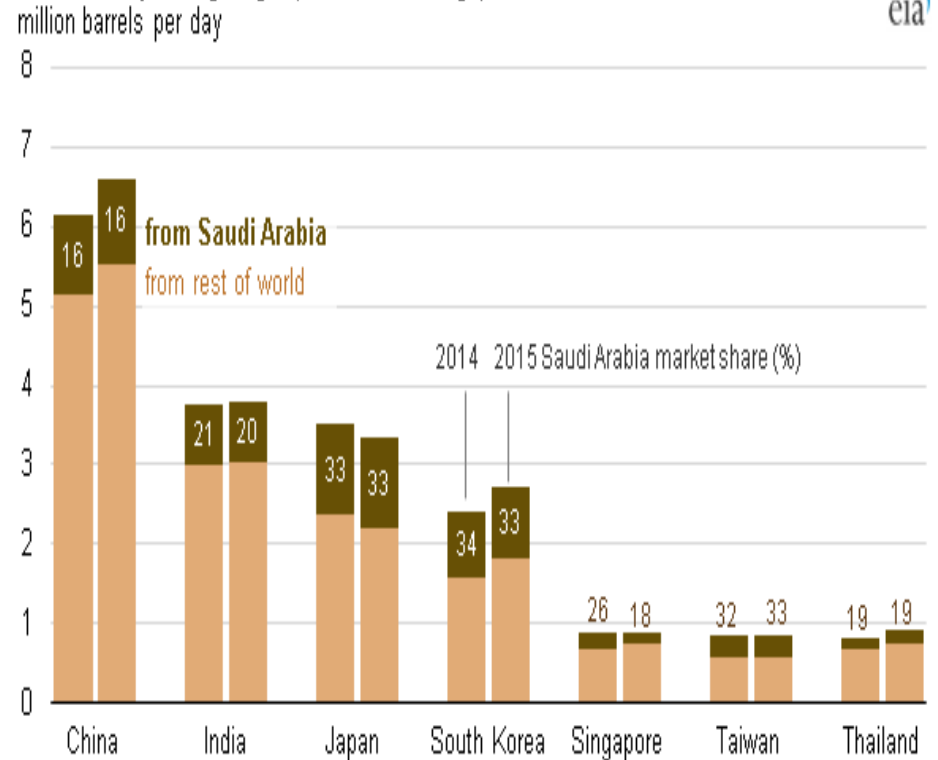
Under uncertainty about US shale response, it is better off for Saudi Arabia to assume that shale supply curve is elastic and not to cut production (the losses are even larger if other OPEC members don't cut and US supply proves to be elastic)

Producers Pursuing a Market Share Strategy

Saudi Arabia Oil Exports, mb/d



Crude oil imports by origin (Jan - Jun average)



In the absence of agreement on cuts and the wide range of uncertainties, Saudi Arabia is seeking to maintain market share and to keep exports above 7 mb/d; in winter, exports could jump

Saudi Arabia has succeeded in maintaining its share in key markets in Asia in face of very tough competition

Iraq's Oil Sector Challenged

Iraq Rig Count



Iraqi rig count has halved and the government is facing serious fiscal pressures and security challenges

New and Old Production Plateau, mb/d

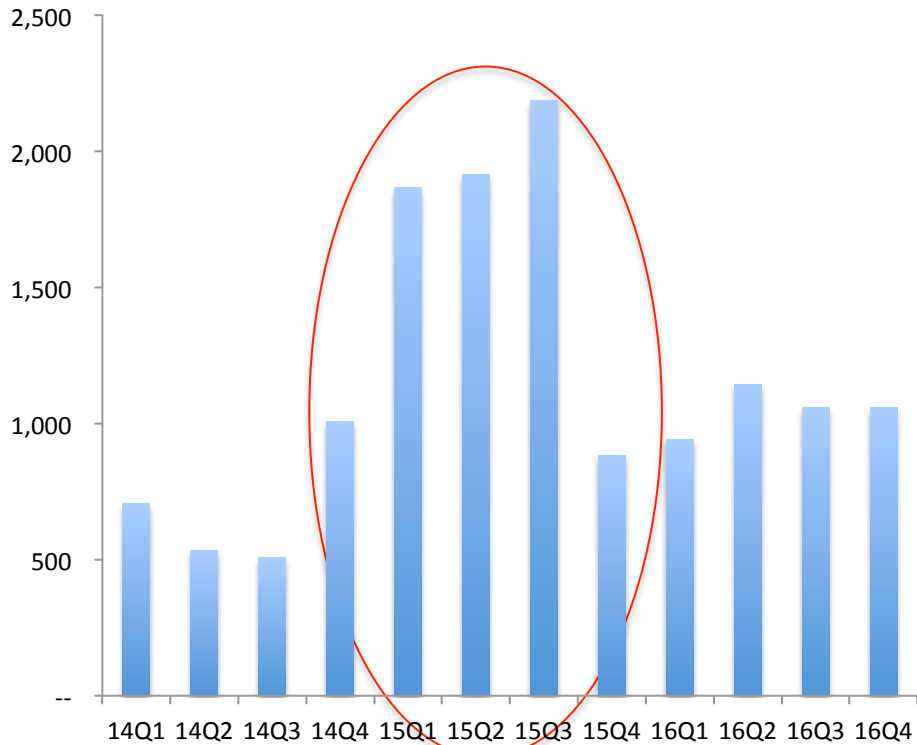
Field	Operator	New Plateau	Was	Finalized?
West Qurna-1	ExxonMobil	1.6	2.825	Yes
Zubair	Eni	0.85	1.2	Yes
West Qurna-2	Lukoil	1.2	1.8	Yes
Rumaila	BP	2.1	2.85	Yes (July '14)
Halfaya	PetroChina	0.4	0.535	Yes (July '14)
Majnoun	Shell	1-1.2	1.8	decision delayed to 2017
Gharaf	Petronas	unknown	0.23	No
Total		*7.15-7.35	11.24	

Iraqi government has been forced to revise downwards its production target negotiating with oil companies new production plateaus and reducing investment

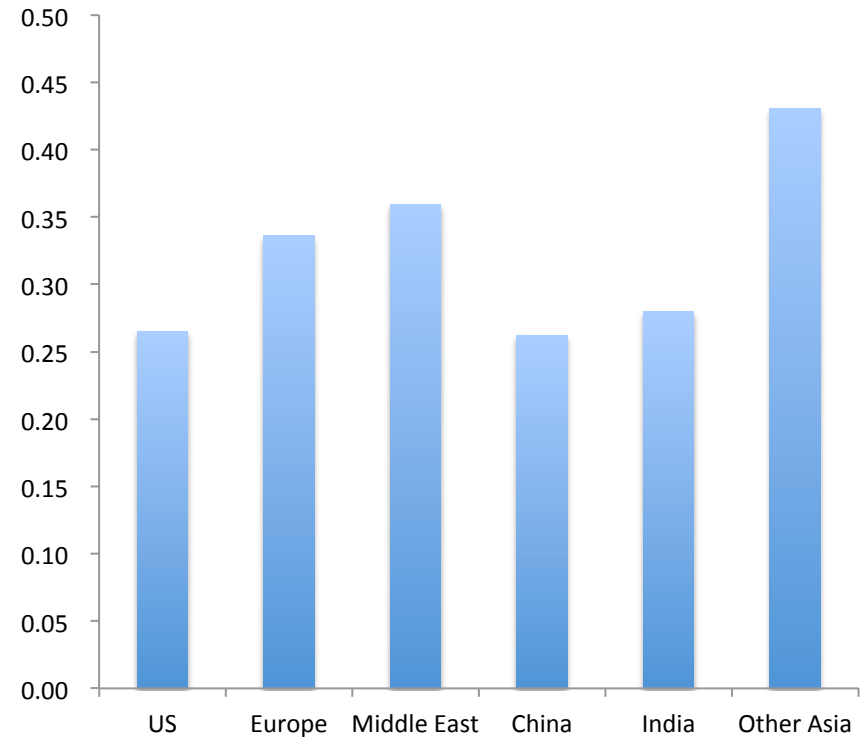
The Demand Response in the Low Price Environment

Oil Demand Strong Has Been Strong

Global Oil Demand, y/y change, kb/d



Oil Demand Growth 2015, y/y change, mb/d

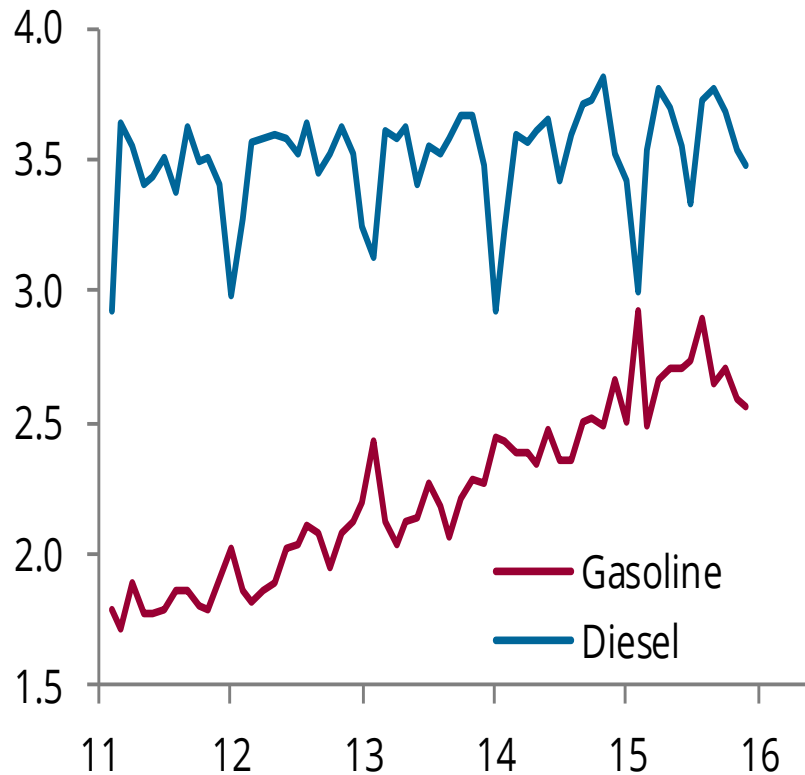


Oil demand has been stronger than initial expectations in 2015 driven in part by cheaper oil prices

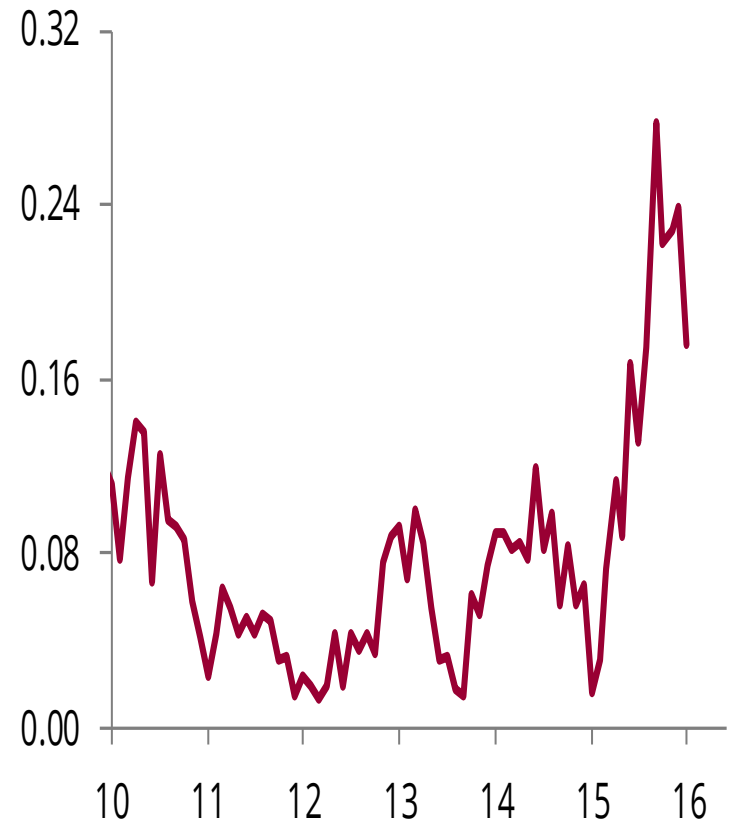
Sources of demand growth have become more varied with China being an important but not the only engine of oil demand growth

Change in the Dynamics of Products Demand

China's diesel/gasoline demand, mb/d



Diesel exports, mb/d

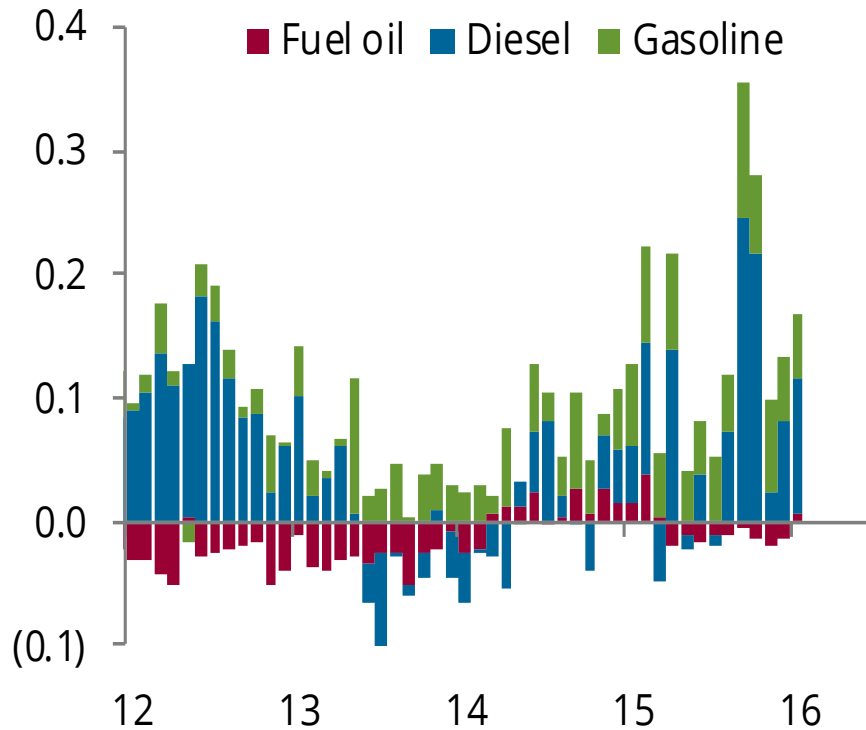


In China, gasoline demand has outperformed that of diesel as the economy continues to rebalance from investment towards consumption

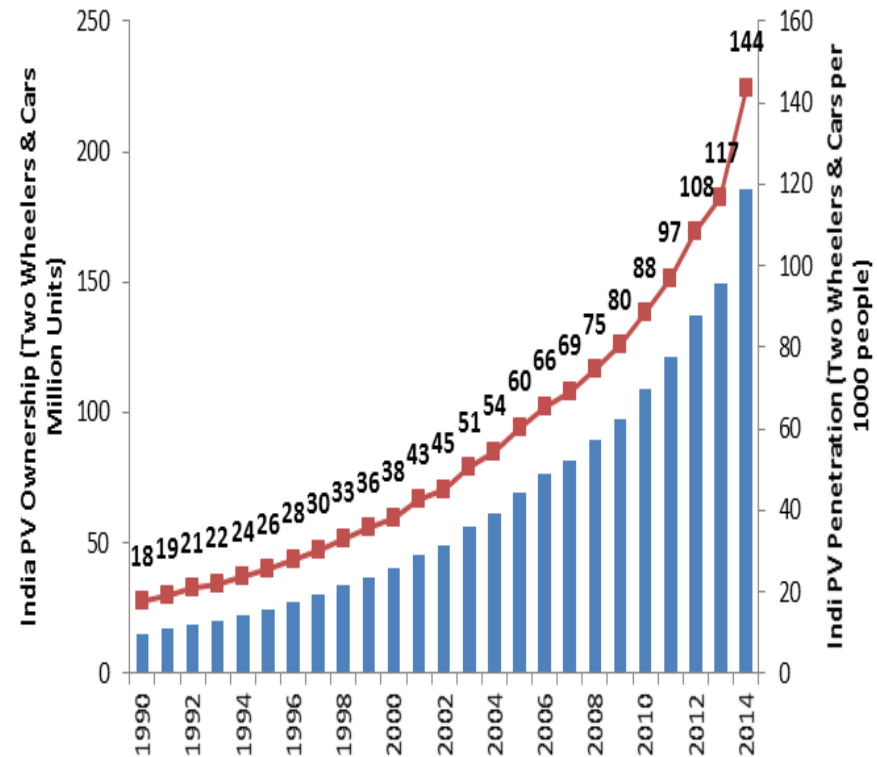
China's diesel exports have jumped to a record level as demand growth for diesel slows down and topping refineries given licenses to import crude and export products

Indian Oil Demand

India's Oil Demand, y/y growth, mb/d



Vehicle ownership and penetration (cars plus two-wheelers)

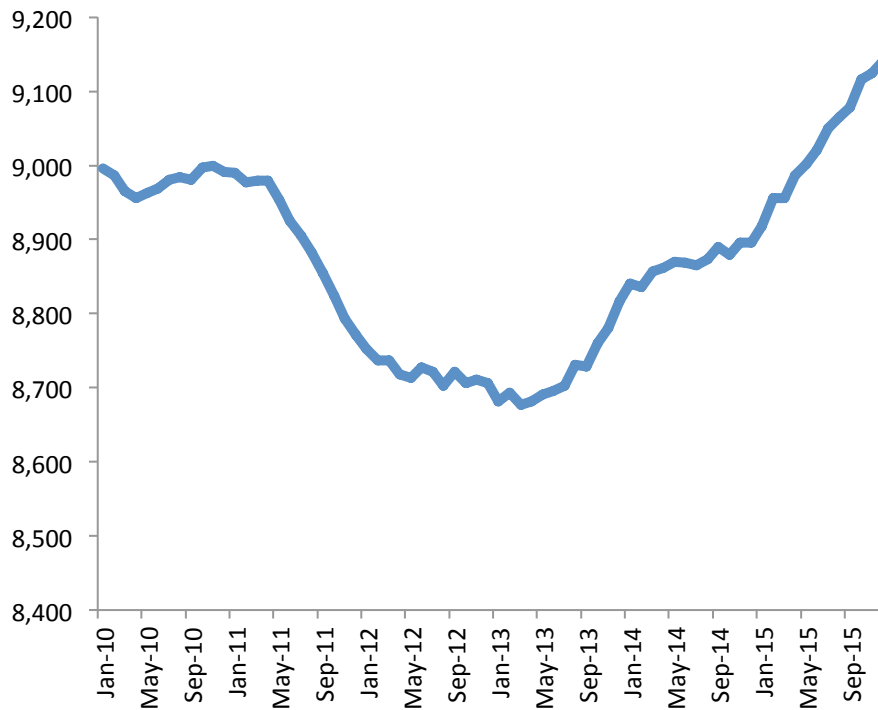


In India, gasoline sales have seen a sharp rise almost doubling from the 2009 level and in 2015 India contributed to oil growth demand as much as China (0.3 mb/d)

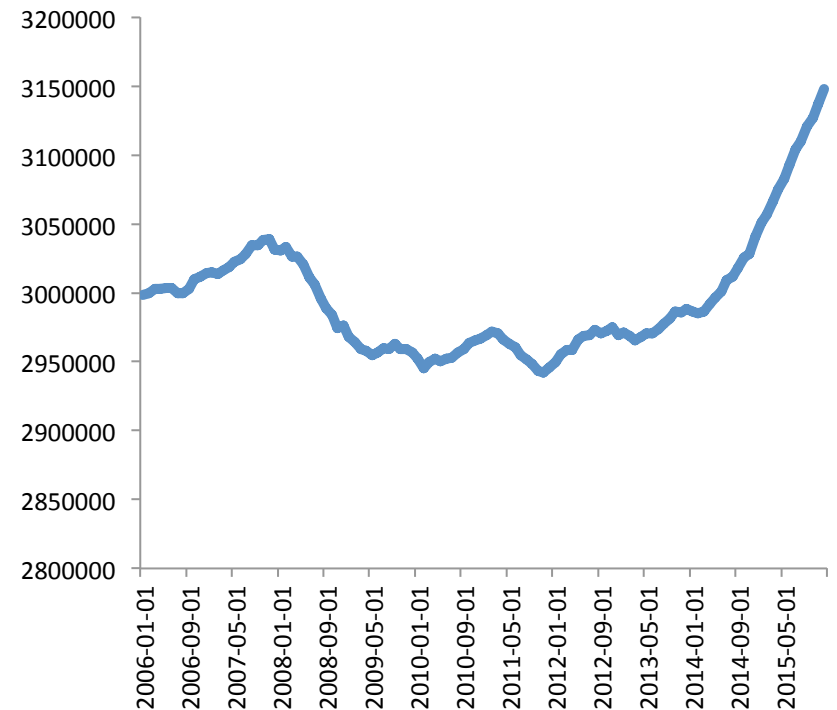
Personal vehicle ownership in India has been increasing especially for two wheelers

US Oil Demand

US Gasoline Demand, kb/d, Moving 12-month Average



Moving 12-Month Total Vehicle Miles Traveled, Million Miles



Gasoline demand in the US has been rising benefiting from cheap gasoline at the pump and improvement in job prospects

Americans are also driving more and for longer distances

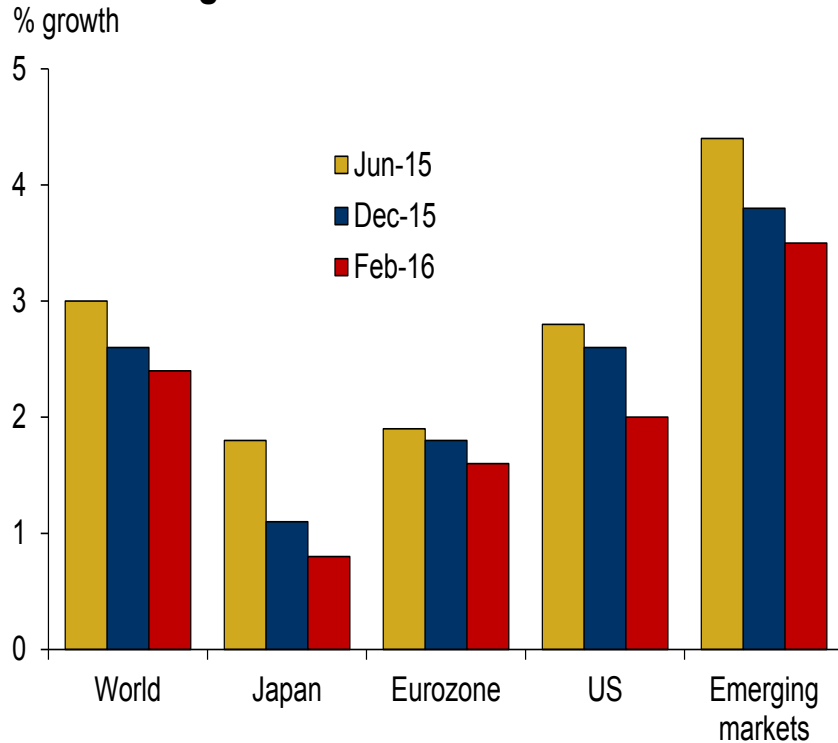
Oil Prices: Lower for Longer? Or Higher Sooner Than Later?

The Case for Lower Oil Prices For Longer

- High level of crude and products stocks would put a cap on the oil price
- Many sources of supply that could come back to the market (Libya, Iran)
- Cooperation to cut or freeze production not feasible (OPEC no longer functional; on the contrary maxing production and competing for market share)
- Cost deflation structural and efficiency measures would accelerate
- Demand growth will ease (the world of lows + climate change concerns)
 - Short and long-term impacts
- US shale responds fast in a higher oil price environment putting a cap on the oil price

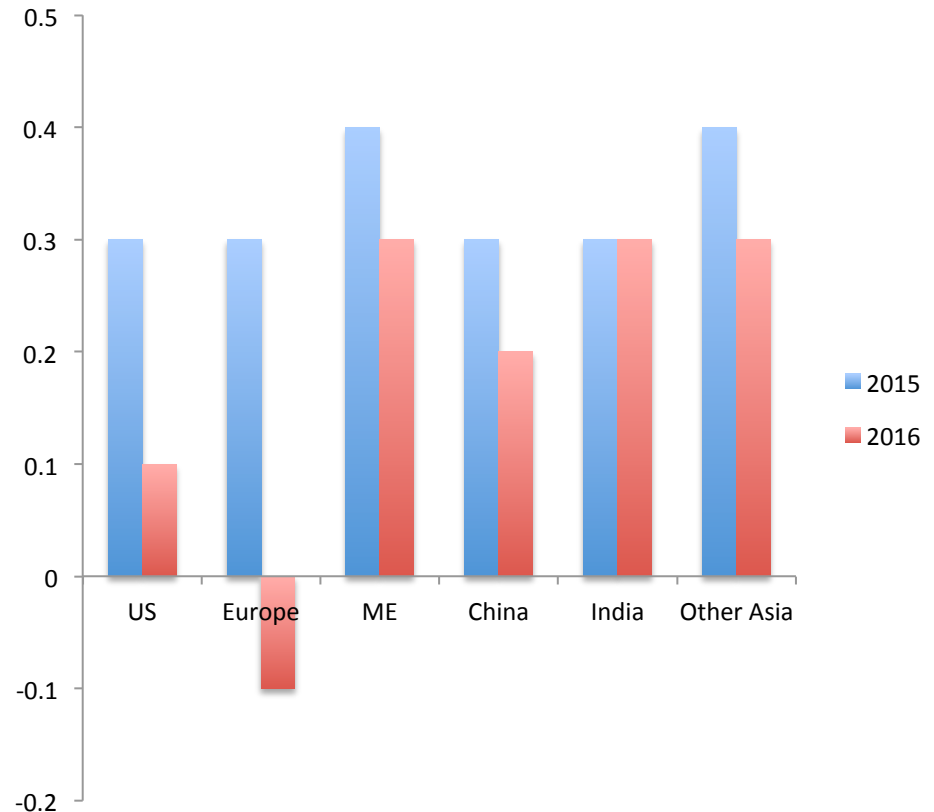
(1) Demand Growth Expected to Weaken as Global Economy Slows Down

World: OE growth forecasts for 2016



Source : Oxford Economics/Haver Analytics

Growth in Demand, y/y mb/d



Economic growth in different regions continue to be revised downward affecting demand growth

Slowing oil demand growth in most countries and regions particularly Latin America

Why Has the decline in Oil Price Failed To shock more?

Increase in Domestic Energy Prices in SA

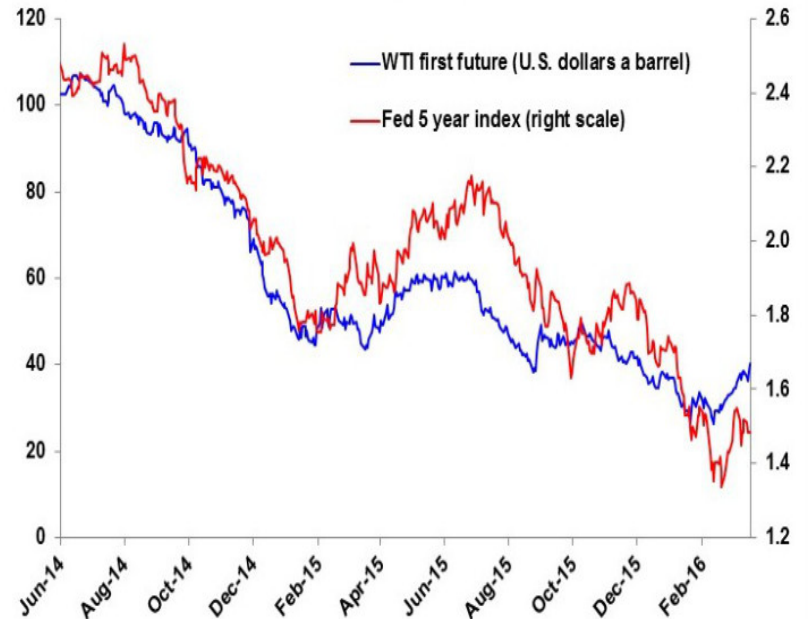
	Old Price	New Price	Percentage Increase (%)
Natural Gas (\$/mmbtu)	0.75	1.25	67
Ethane (\$/mmbtu)	0.75	1.75	133
Gasoline (\$/Litre) (High Grade)	0.16	0.24	50
Gasoline (\$/Litre) (Low Grade)	0.12	0.2	67
Diesel Transport (\$/Litre)	0.067	0.12	79
Diesel Industry (\$/Barrel)	9.11	14.1	55
Arab Light Crude (\$/Barrel)	4.24	6.35	50
Arab Heavy Crude (\$/Barrel)	2.67	4.4	65
Kerosene (\$/barrel)	23	25.7	12

Oil exporting countries cutting spending and introducing reforms to rationalize spending

Chart 3

Oil Prices and Inflation

Low oil prices drag down inflation expectations.



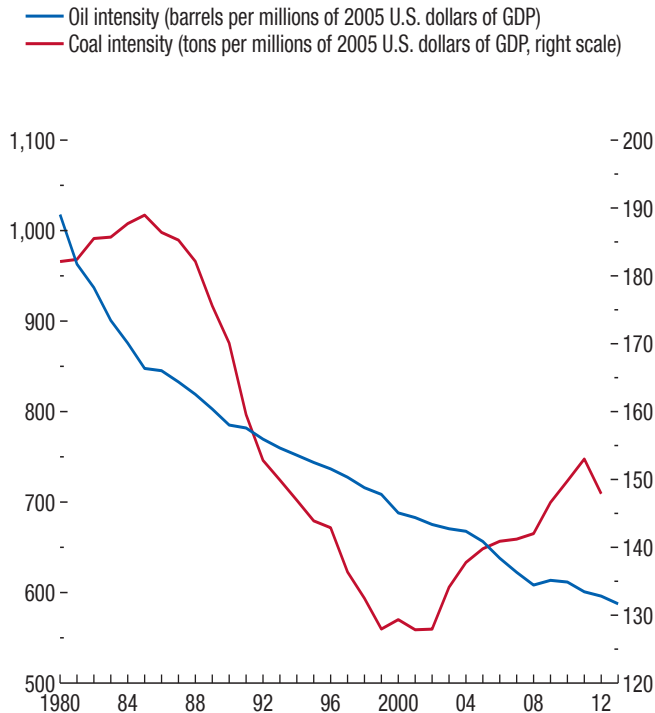
Sources: Bloomberg, L.P.; and Citi Market Commentary, January 28, 2016.

Note: The chart measures long-run inflation expectations, measured by the Fed 5-year index, versus the price of oil, measured by the West Texas Intermediate (WTI) first future.

Oil exporting countries cutting spending and introducing reforms to rationalize spending

ST vs LT: The Income Effect Remains Strong Even After Accounting for Improvements in Efficiency

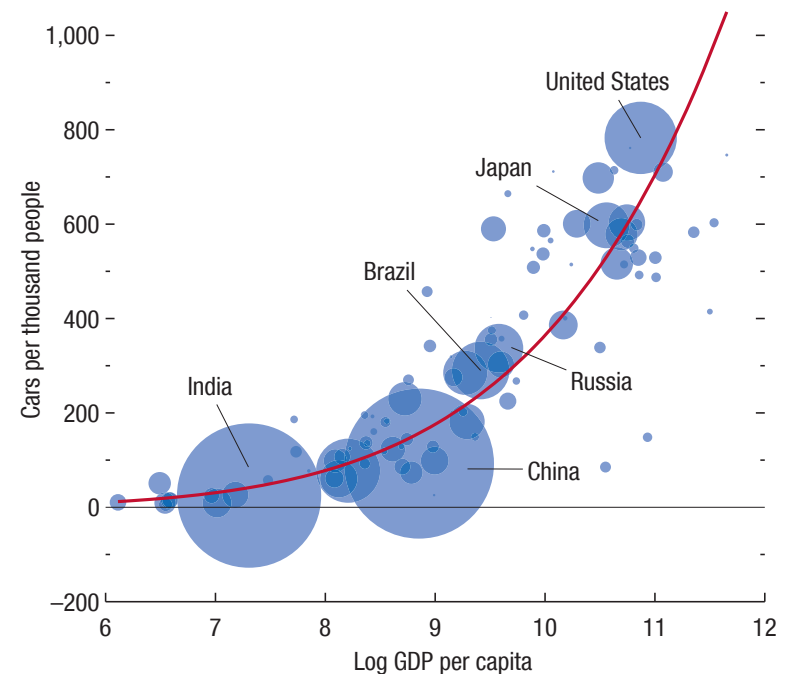
World Energy Intensity



Sources: U.S. Energy Information Administration; World Bank, *World Development Indicators*; and IMF staff calculations.

Oil intensity has fallen sharply in recent years globally

Car Ownership and GDP per Capita, 2013



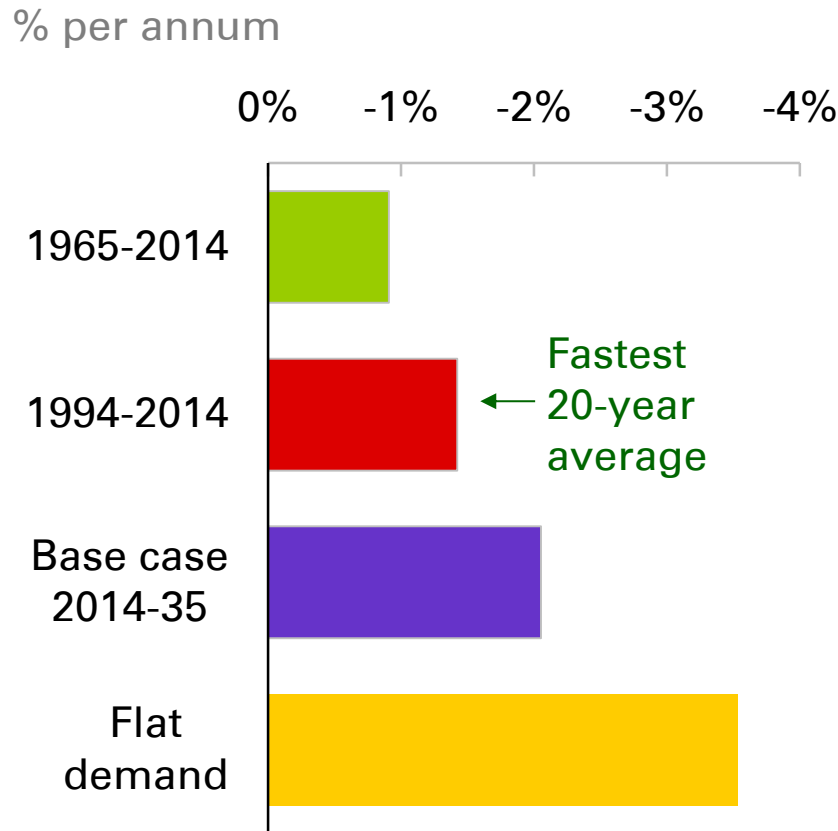
Sources: International Road Federation, *World Road Statistics*; and IMF staff calculations.

Note: Size of bubble represents population in 2013. Cars per thousand people for India is from 2012.

But mitigated by income effects; car ownership is strongly linked to improvements in income

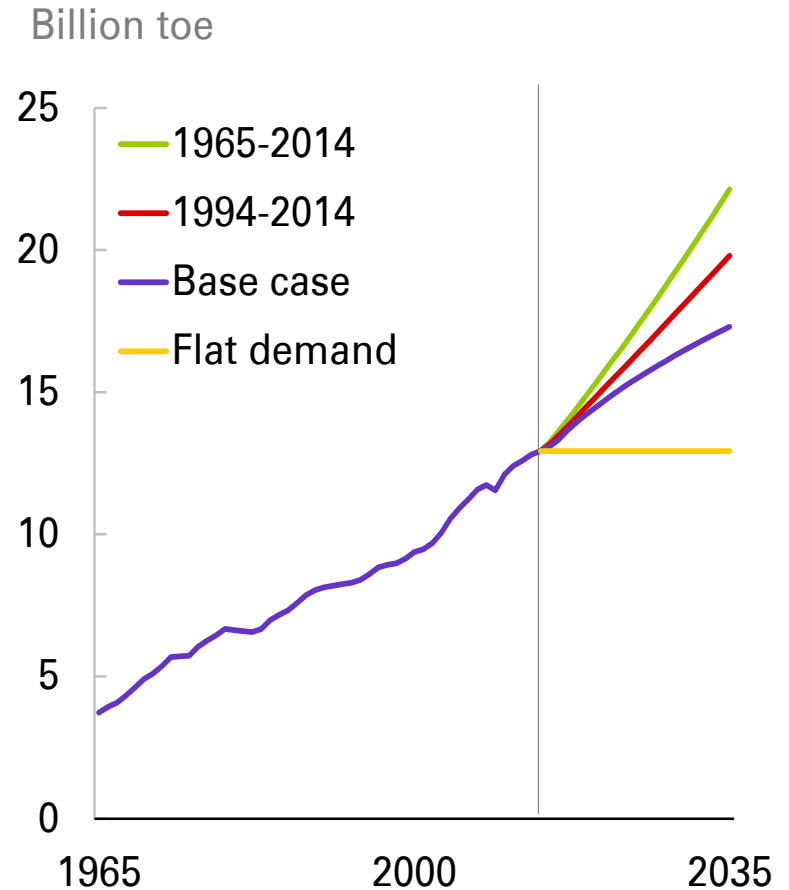
Climate Change Policy Responses and Energy Demand

Decline in world energy intensity



The period 1994-2014 has seen some of the biggest improvements in global energy intensity

World energy demand

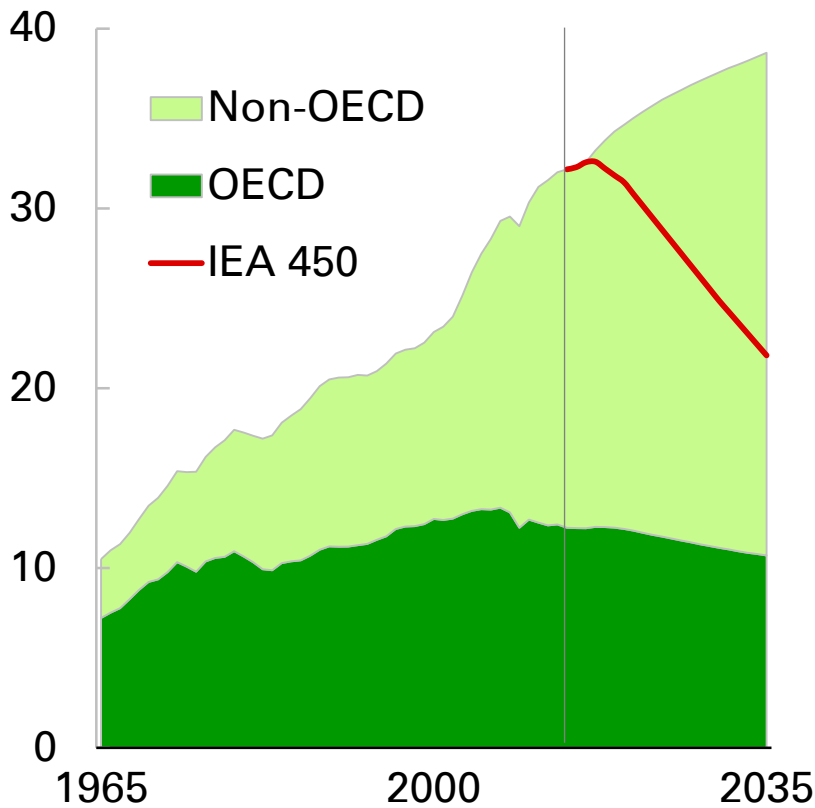


Assuming even faster declines in the world's energy intensity in the next two decades, energy demand will continue to increase (including oil demand)

In Most Base Cases, Oil Demand Will Continue to Rise

Carbon emissions

Billion tonnes CO₂

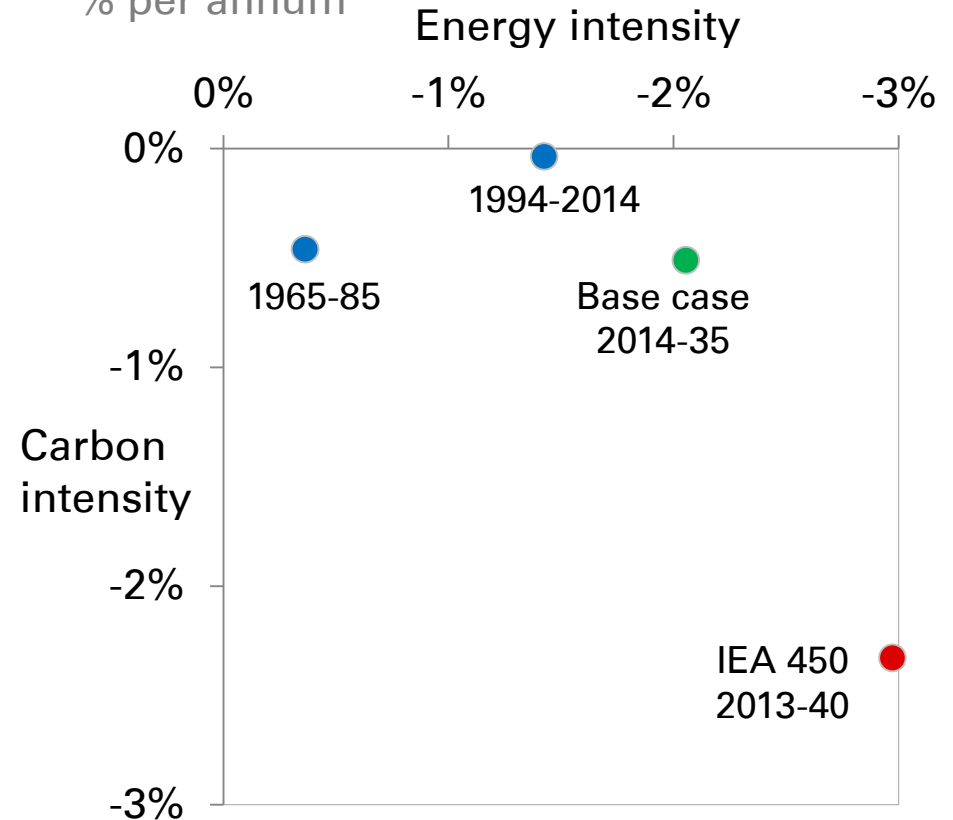


Carbon emissions can be reduced both by improvements in energy intensity and carbon intensity (mainly changing the energy mix)

Source: BP

Changes in intensity

% per annum



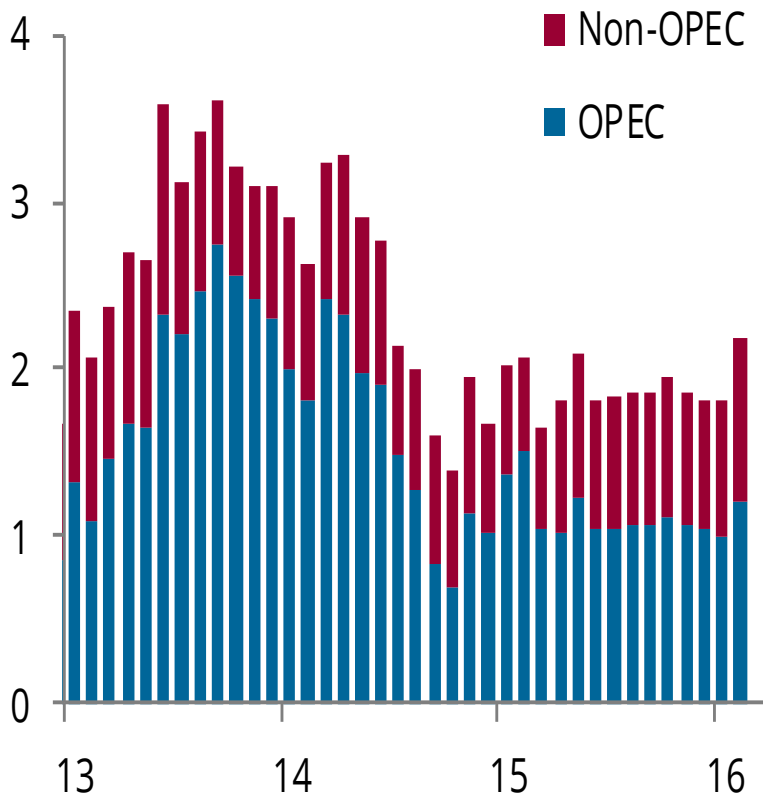
The Base Case included massive improvements in both; to reach IEA's 450 scenario, you need even further drastic improvements

The Case for Higher Oil Prices Sooner Rather Than Later

- Demand will continue to grow at its historical trend in part encouraged by low oil prices
- Cuts in investment are so deep that they will have big impact on future supplies both inside and outside the US
- The ability of the US shale supply respond in a higher oil price environment is constrained
- Geopolitical deterioration and unplanned outages will increase
- Decline rates in mature fields will accelerate
- When activity picks up, cost of services will go up
- Should not exclude the possibility of producers' agreement on output

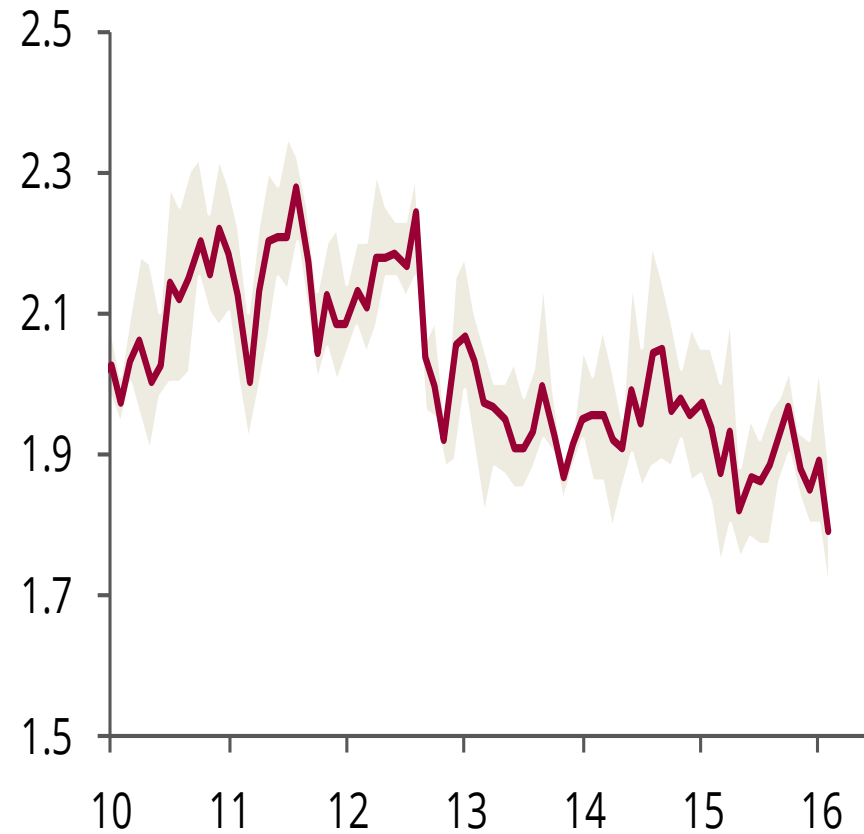
Unplanned Upstream Outages Rising

Unplanned upstream outages, mb/d



Upstream outages have been on the rise in recent months led by countries like Nigeria, Venezuela, Iraq, Colombia, and Libya

Nigerian Oil Output, mb/d



Especially in weak states where dependency on oil revenues is very high