Citi Research

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The US Oil and Gas Markets: A topsy-turvy volatile future

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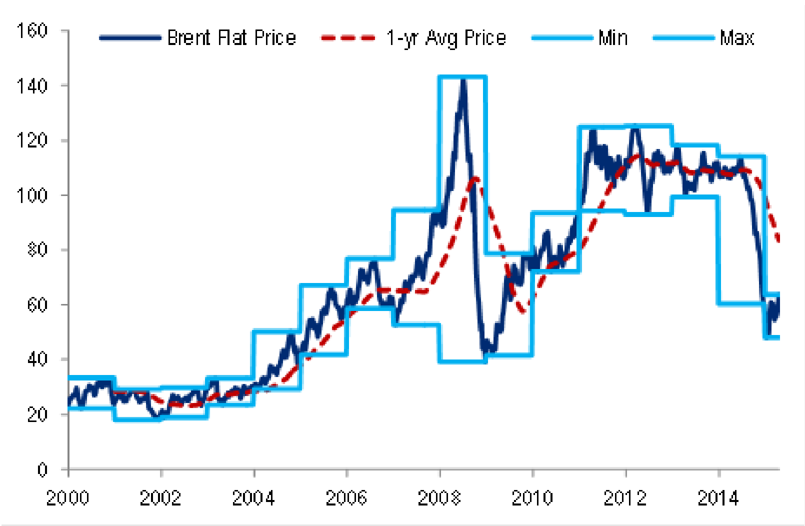
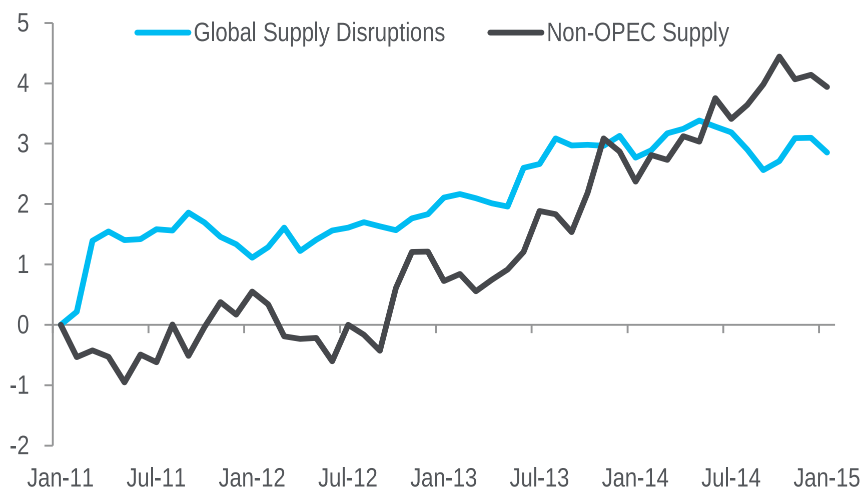
Oil Prices have been Volatile and are in for a Volatile Ride Ahead

North America's growing oil production (well over 1-m b/d per year), against a background of weak global oil demand, a stronger dollar, with a broad macro sell-off too; bullish geopolitics have been eclipsed for now…

Brent crude oil prices broke out of its range to far lower levels ($/bbl)



Global geopolitical supply disruptions more than matched by growth in North American oil production (m b/d)



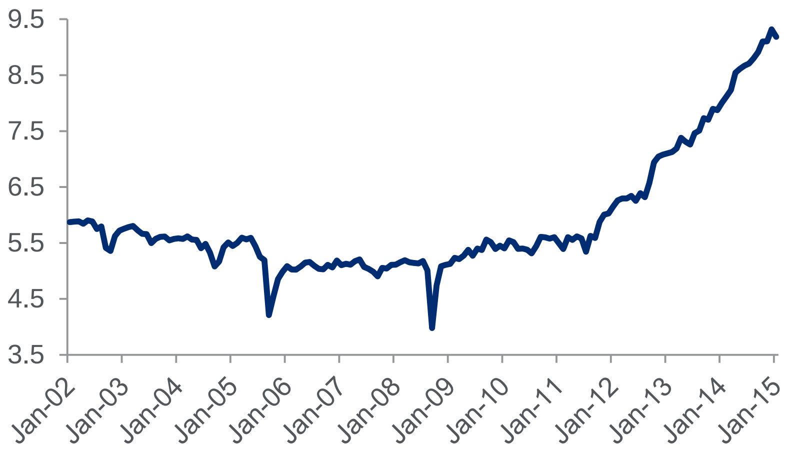
- Volatility will be driven by shut in production coming online, and offline production coming online (i.e. more disruptions given the failure of the petro-state)
- "Call on US" replacing "Call on OPEC" also promises a rougher ride ahead, as reducing US production requires a cold sweat but the rebound can be more rapid

Source: Bloomberg, EIA, Citi Research

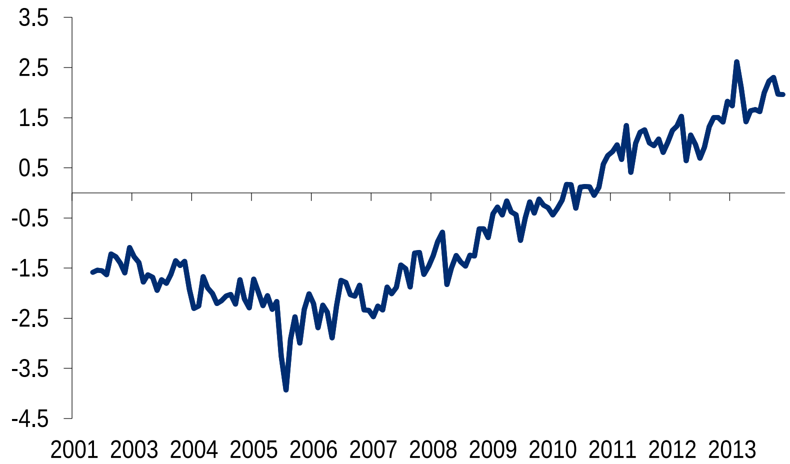
US production growth one of three factors in last year's price collapse

US crude production hit 9-m b/d in October 2014 monthly data, as net oil imports have plummeted and net product exports surged as the shale revolution has proceeded.

US crude production (m b/d)



Net product exports as high as 2.5-m b/d in Dec-13



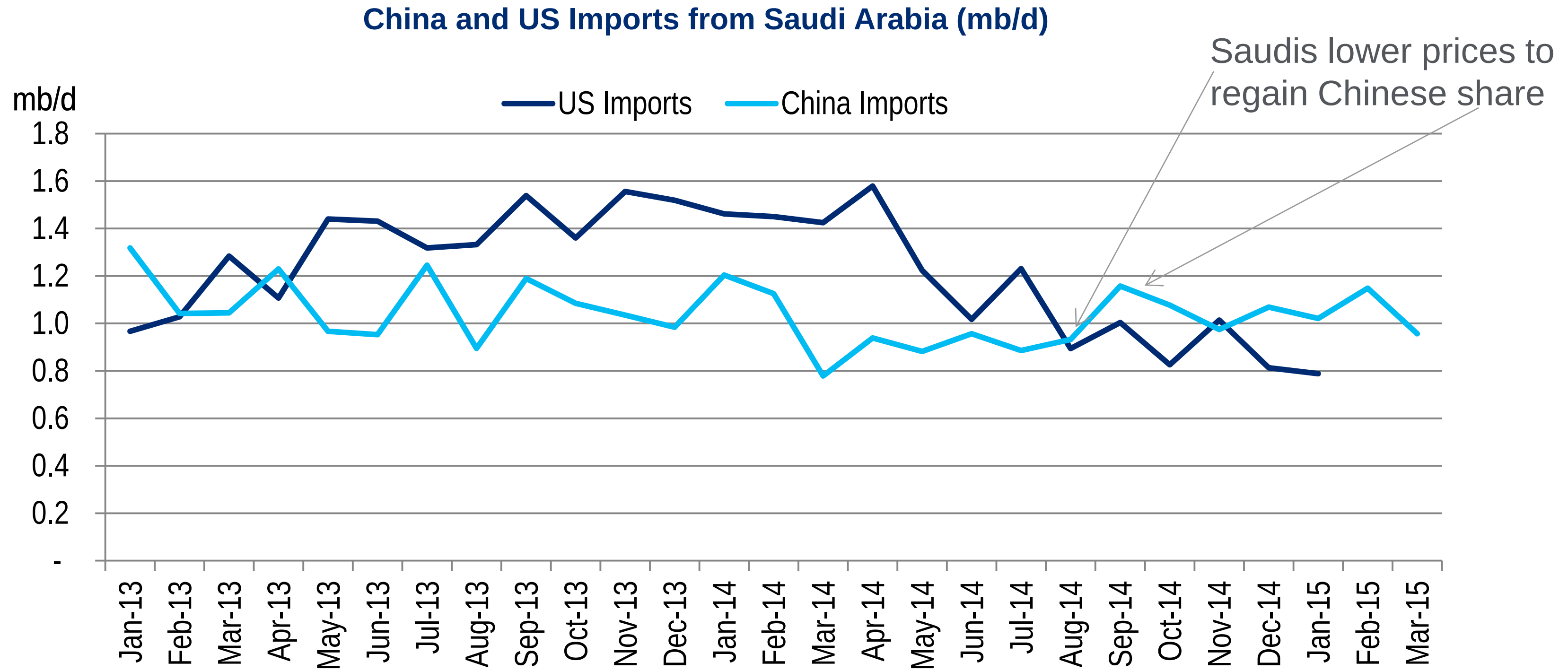
Net oil imports (m b/d, crude and oil products)

Three factors driving price decline

1. **Oil demand**, like other commodity demand, was sluggish due to weakening global economy; was expected to rise 1.35-m b/d but rose only by 650-k b/d, a 700-k b/d gap.
2. **Oil supply** was surprisingly robust, particularly from US and Canada, which added nearly three times as much supply as demand; most importantly turned the Atlantic Basin from being short light/sweet crude to being glutted
3. **Saudi Arabia** decided to abandon its role as targeting a price and being a swing producer and decided to push for market share

Source: EIA, Citi Research

Supply, demand and Saudi market share are longer-term critical issues

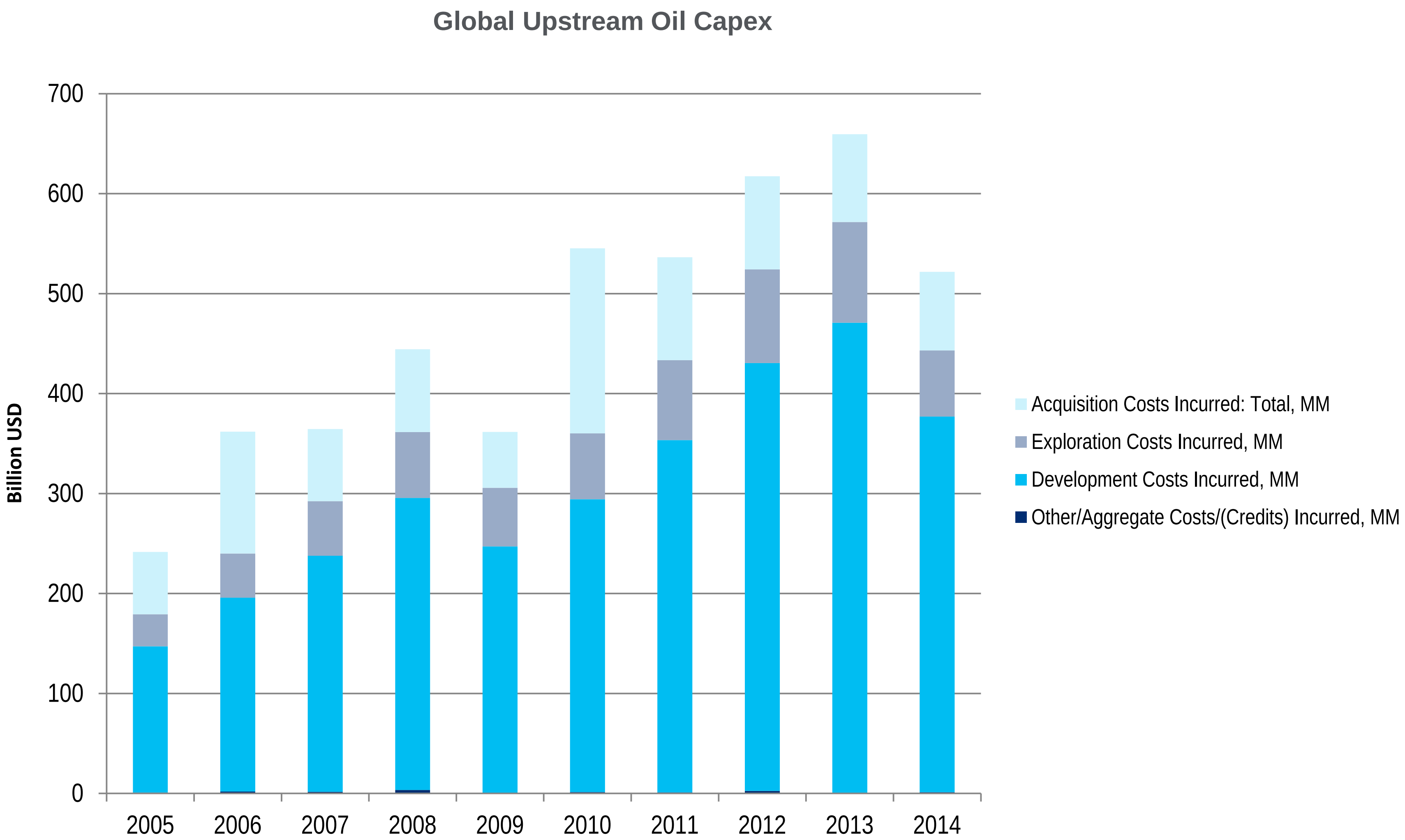


- Saudi Arabia has confronted an existential problem in a slow growth global economy, losing market share in its two largest markets, the US (higher US production) and China (lower demand, Russian competition)
- Chinese oil demand appears to have reached a turning point with diesel demand peaking within the next two-three years and gasoline demand in the next 5-10 years, a clear sign that oil demand growth is weakening
- Oil demand is becoming less intensively related to GDP growth globally
- Given the inelasticity of supply (as well as demand) to prices and Saudi Arabia's decision not to cut but to actually increase exports, the market has had to confront a long sweat to reduce supplies (including potentially from the US).

Source: EIA, Bloomberg, Citi Research

Oil industry is largest sector of world economy—in terms of trade and investment flows

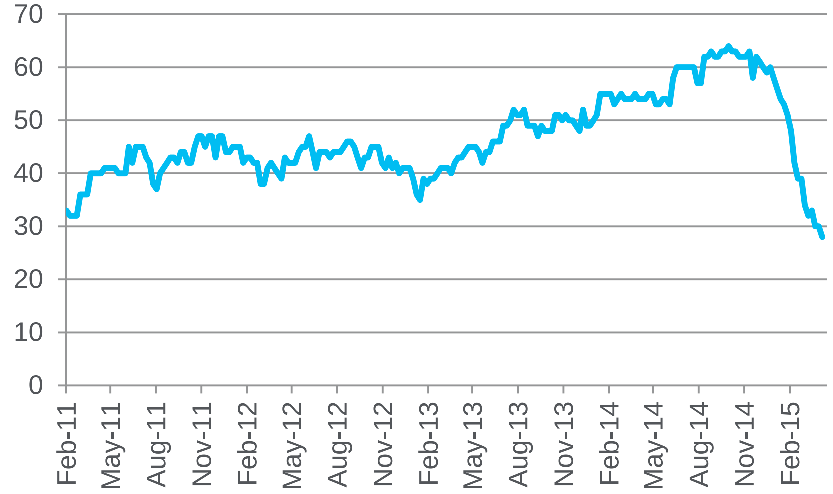
The global crude trade was a $3 trillion business in 2013, so a 50% hit hurts. US capex is expected to be down 40% in 2015, with global capex down around 20%.



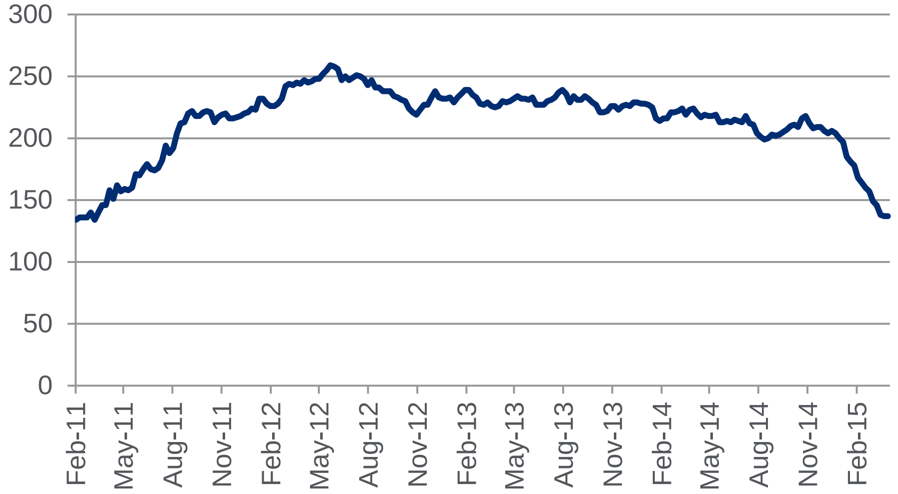
Source: IHS, Citi Research

Oil rig counts down more than 50% from peak…

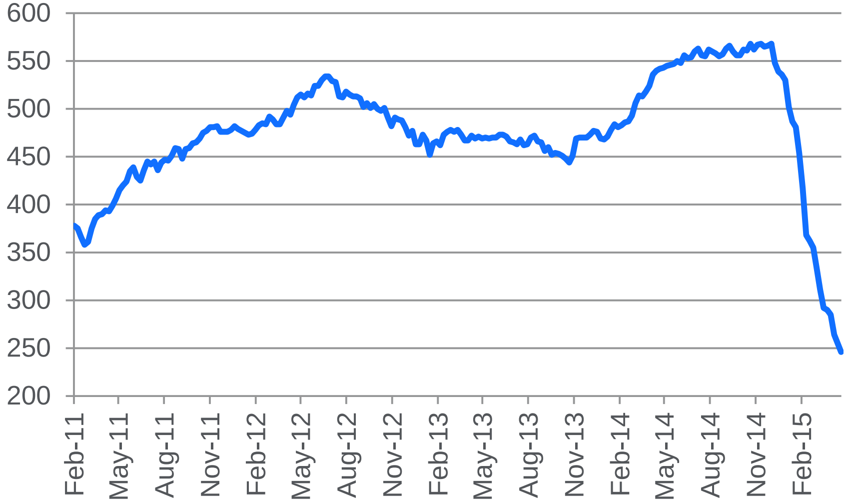
Niobrara oil rig count



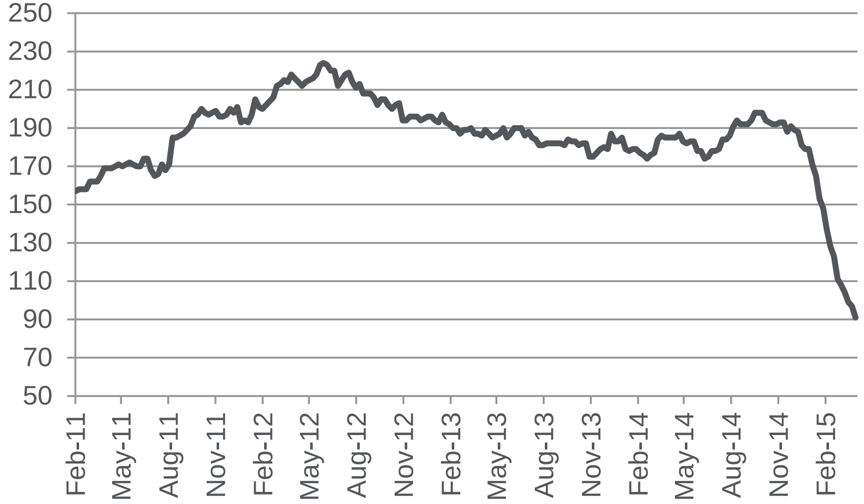
Eagle Ford oil rig count



Permian Basin oil rig count



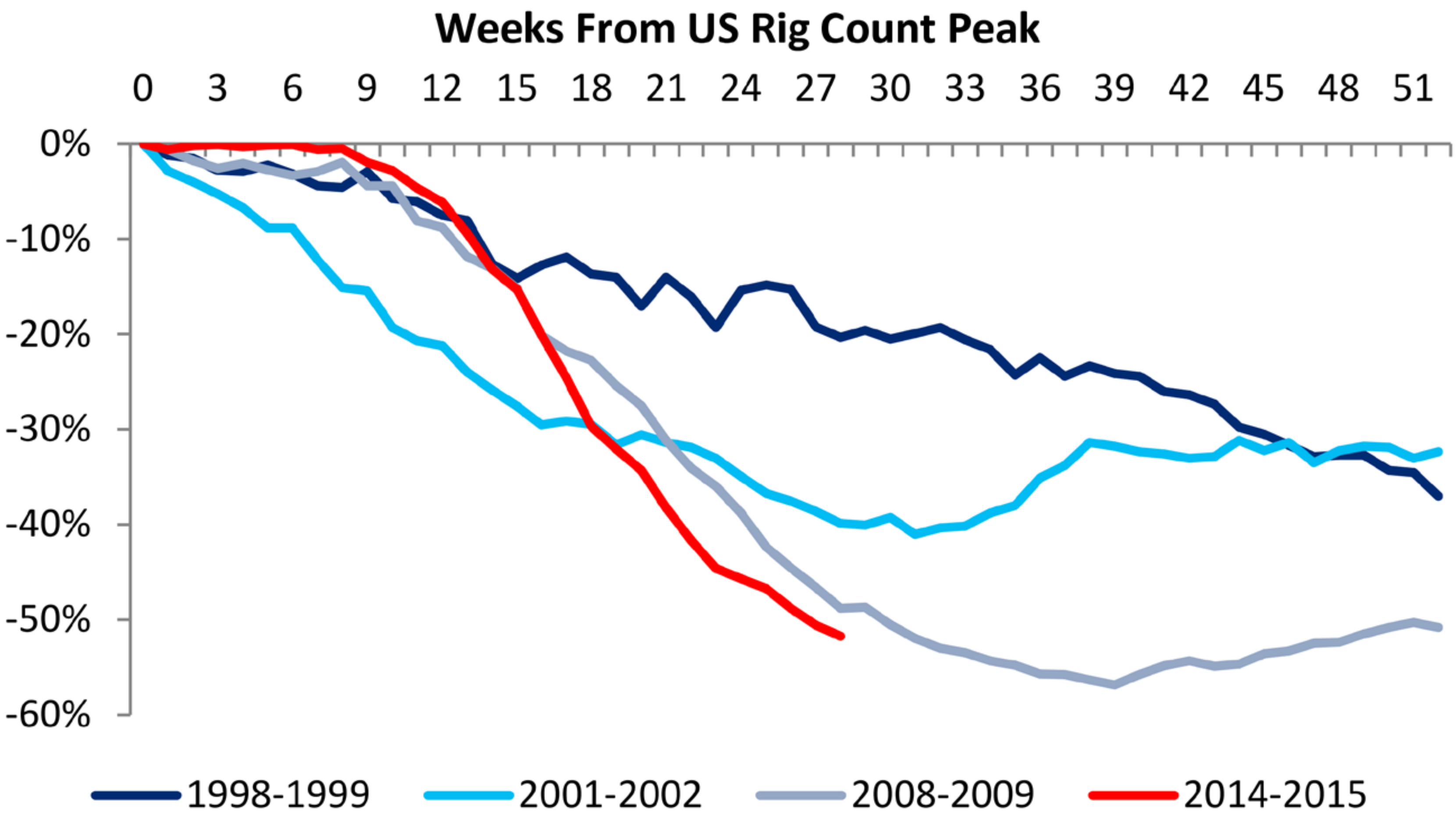
Williston Basin oil rig count



Source: Baker Hughes, EIA, Citi Research

…But could we be approaching a trough?

While the services sector remains cautious on rig activity in 2H, several factors suggest rigs might rebound by more than 100 for horizontal rigs: 1) 25% cost reductions; 2) improving productivity; 3) willingness of equity markets to offer capital

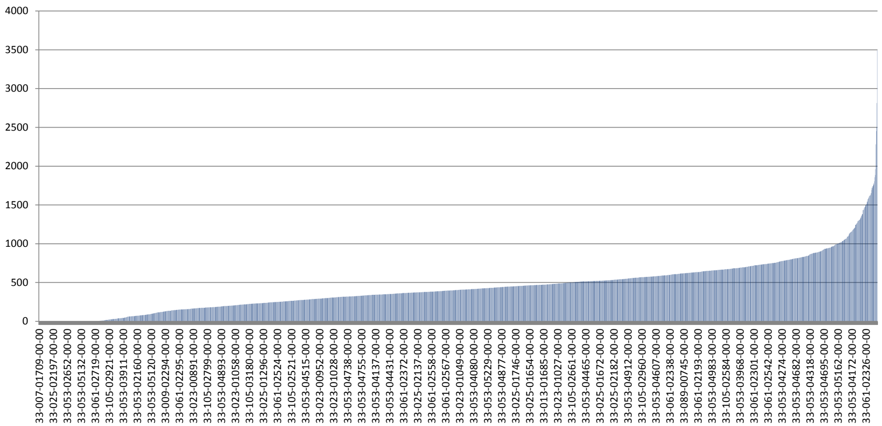


Source: BakerHughes, Citi Research

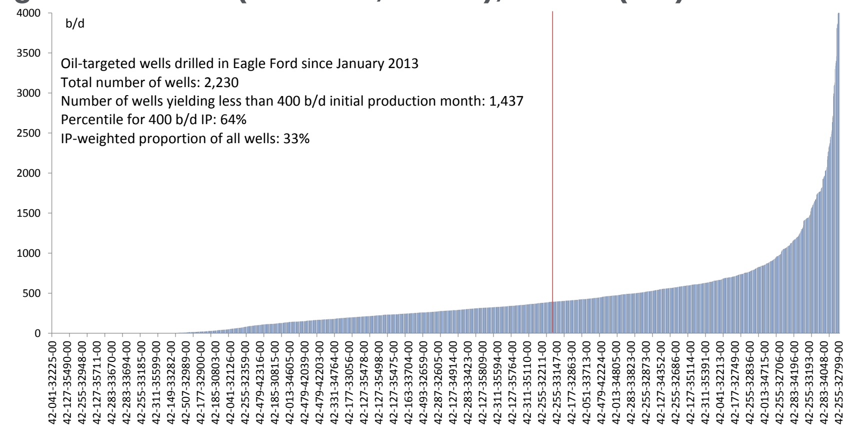
US sector robustness (1): Shale production driven by core areas

In a “80-20”-like rule, the majority of production comes from a relative minority of wells, and average initial production rates rise as the weaker-performing wells are cut first from drilling programs, driving productivity gains

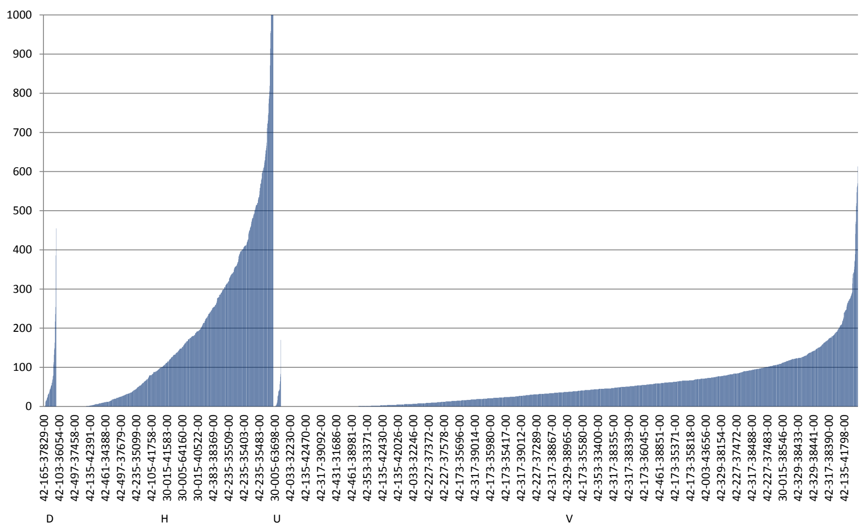
Bakken wells (API nos., x-axis), and IP (b/d)



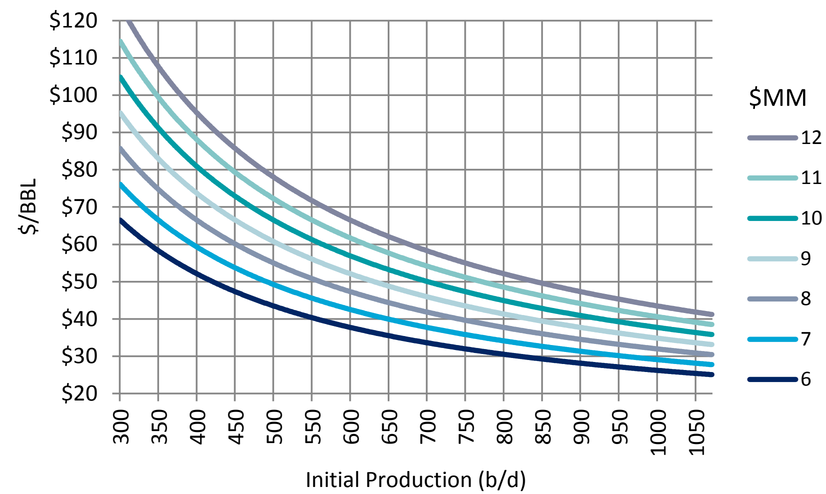
Eagle Ford wells (API nos., x-axis), and IP (b/d)



Permian Basin wells (API nos., x-axis), and IP (b/d)



Eagle Ford breakeven prices vs IP, well costs ($/bbl)

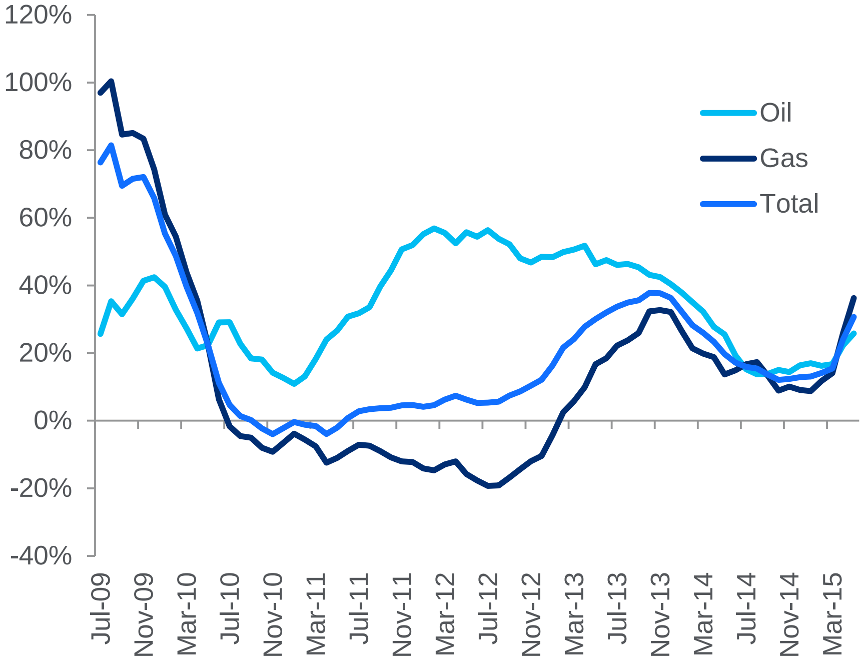


Source: State data, Woodmac, Citi Research

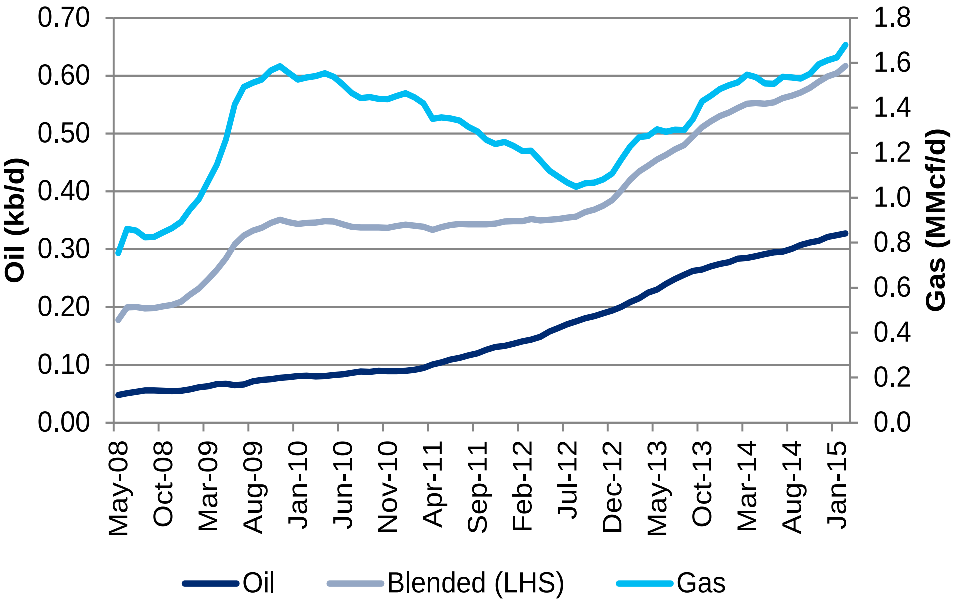
US sector robustness (2): productivity improves competitiveness

For both oil and gas drilling, productivity – measured as initial production from a given well – is still increasing steadily. High-grading and lower utilization of service sector assets could further boost productivity in 2015.

Drilling productivity gains have remained strong and already show signs of spiking in 2015 (YoY IP improvements)



Initial well production per rig at major play is still rising steadily

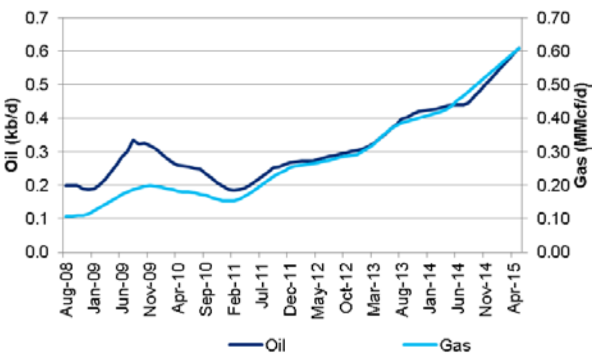


Source: EIA, Baker Hughes, Citi Research

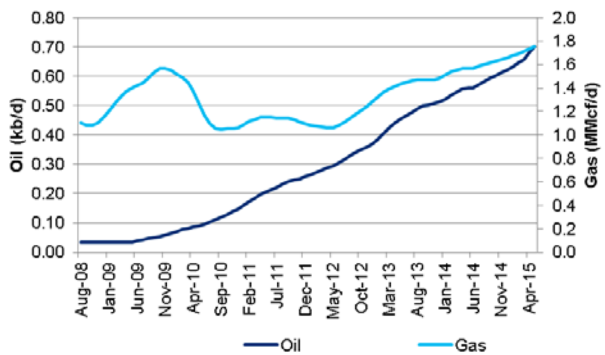
Shale revolution still at early stages of surging productivity gains

In the Big Three plays, new-well production per rig has continued to rise for oil and gas, as initial production (IP) and estimated ultimate recovery (EUR) increase, and days-to-drill a well per rig falls. Similar trends could emerge in frontier basins going forward.

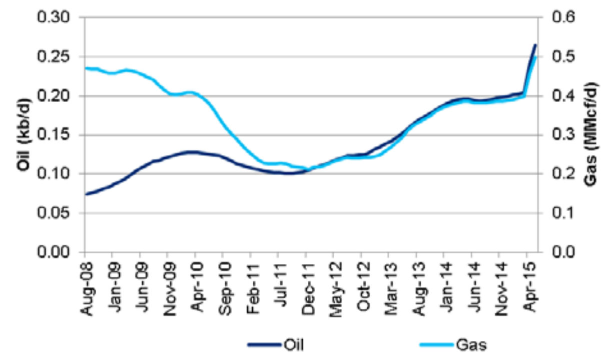
Bakken: first month production per standard rig



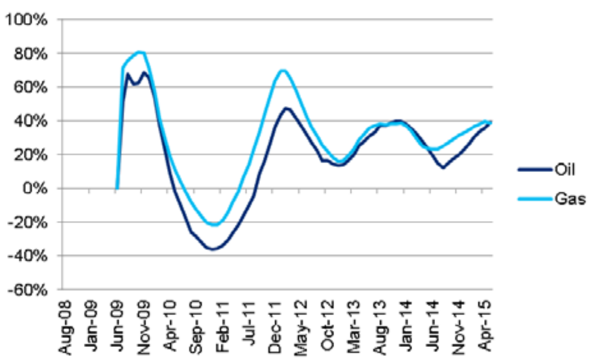
Eagle Ford: first month production per standard rig



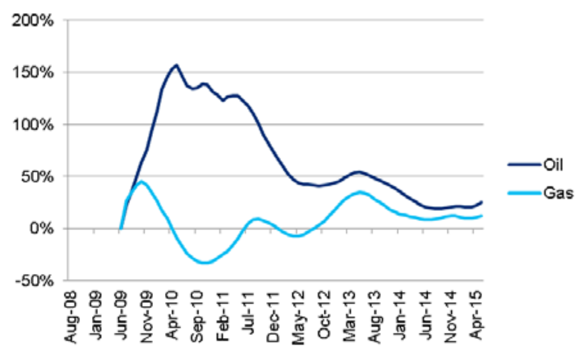
Permian: first month production per standard rig



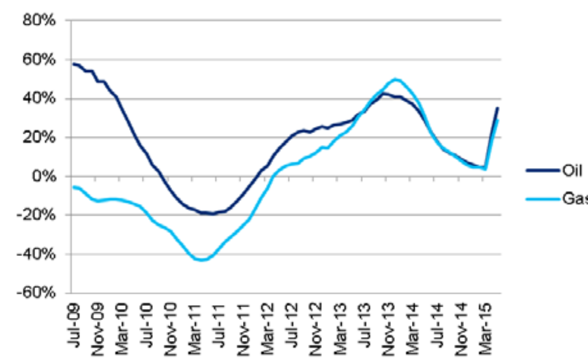
Bakken: y/y productivity gain



Eagle Ford: y/y productivity gain



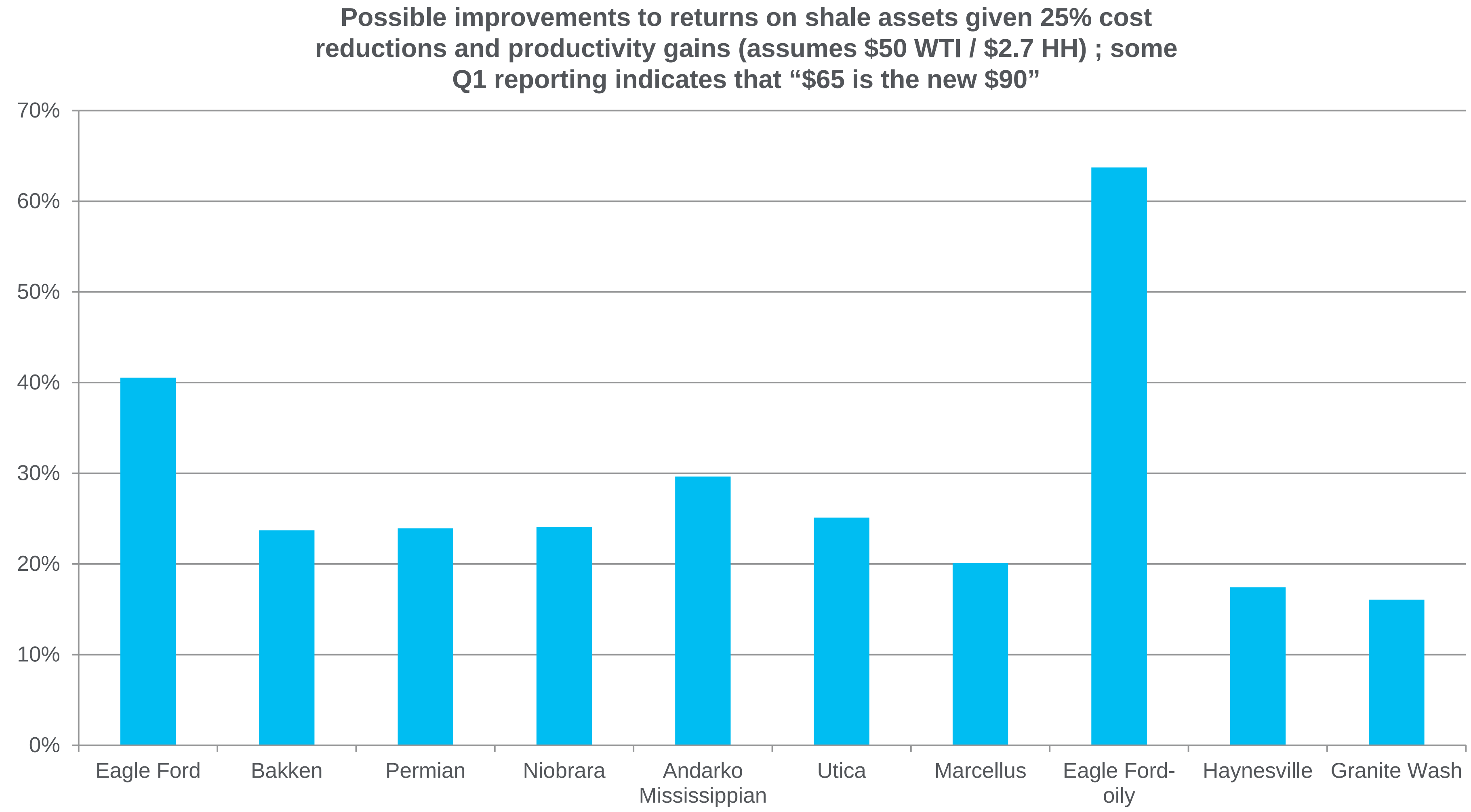
Permian: y/y productivity gain



Source: EIA, Citi Research

Cost reductions and productivity gains should boost shale IRRs

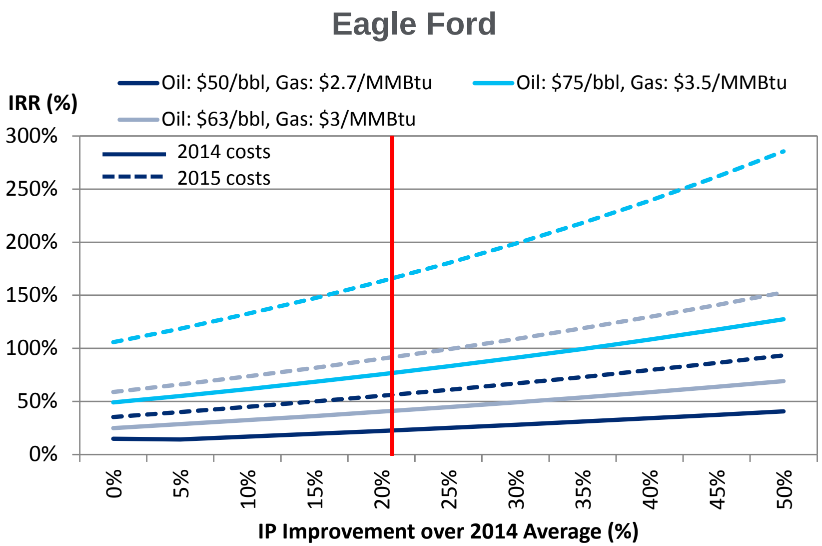
Assuming a 25% reduction in all-in drilling and service costs, combined with current productivity gains holding for 2015, IRRs for “average” shale wells should see a boost. Capital still looks available for drilling.

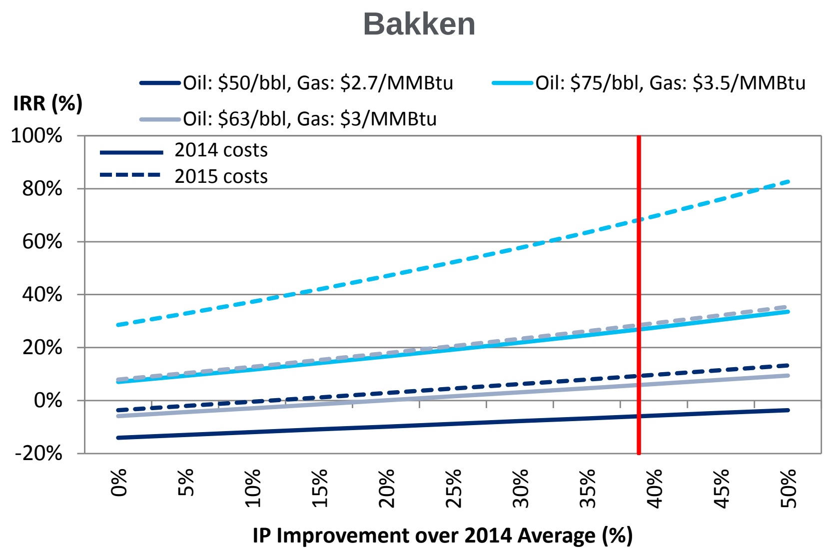


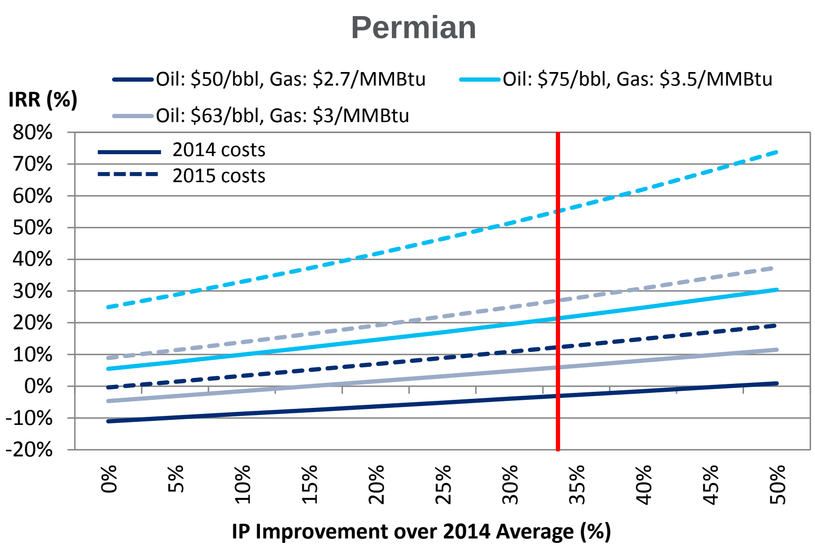
Source: EIA, State Data, Citi Research

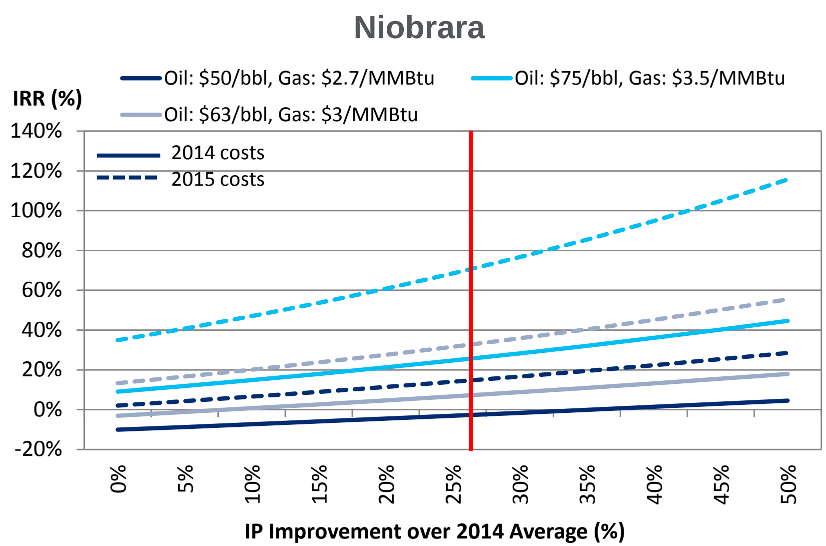
Even in bearish scenario, lower costs keep many wells profitable

In major oil plays, cost reductions and productivity gains will likely benefit IRRs. Citi models 2015 returns on drilling given cost reductions of 25% and persistence of current strong productivity gains. Red line is current level of productivity gains in each basin.





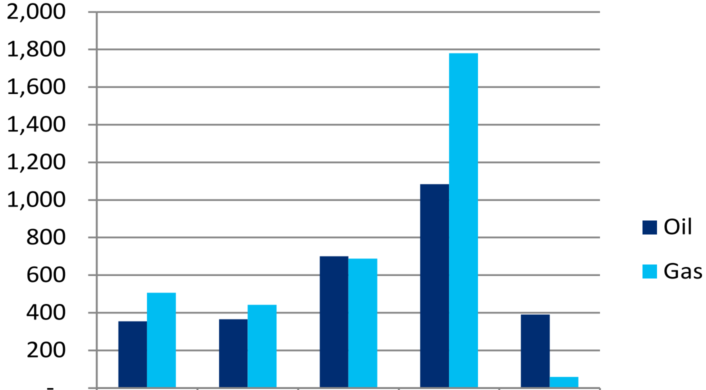




Source: EIA, Company reports, state data, Citi Research

Drilled-but-not-producing wells – looming production surge?

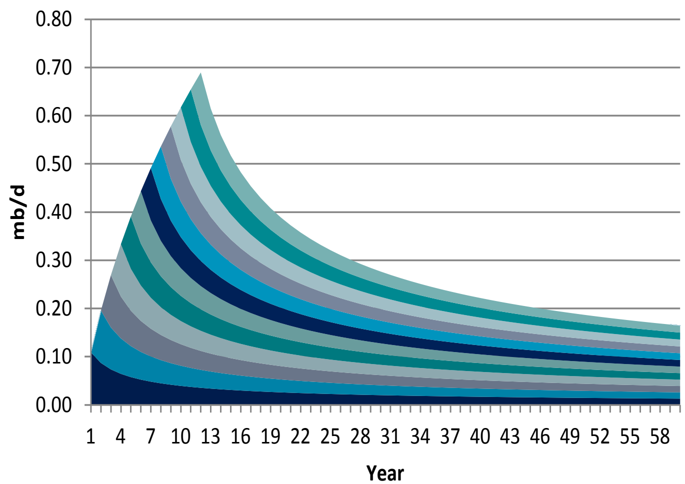
Number of inactive or "drilled-but-not-producing" oil and gas wells by year



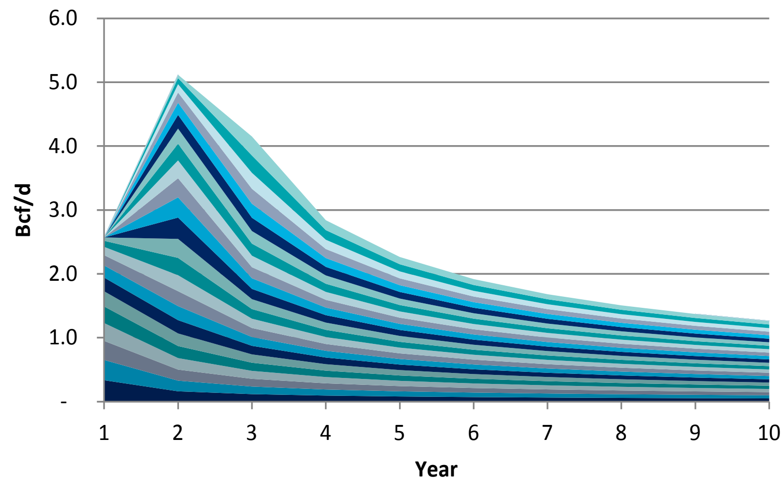
	2011	2012	2013	2014	2015
Oil	355	365	701	1,083	391
Gas	507	442	688	1,780	59

- If we assume that all drilled-but-uncompleted wells (DUCs) from 2013 to 2015 YTD are drilled (not excluding possible dry holes), this would amount to drilling ~2,000 oil wells and ~2,500 gas wells.
- "Max" production cases look at monthly oil production profile if the oil well backlog is cleared in a 12-month period, including possible "dry holes"

"Max" Case - Oil Production from DUCs ~0.7-mb/d oil



"Max" Case - Gas Production from DUCs ~5.0-Bcf/d

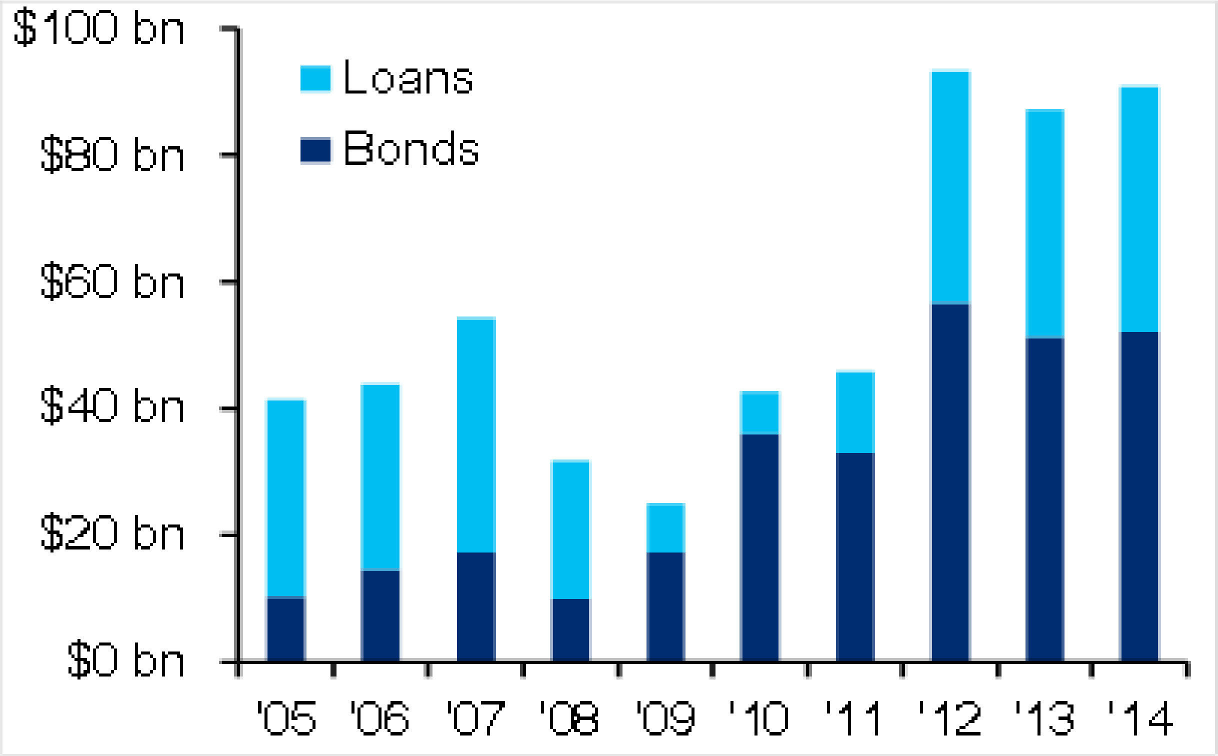


Source: State Data, Citi Research

High yield debt has been a big source of capital for shale

US shale drillers had been cash flow negative before the oil price collapse, with expectations of going cash flow neutral in 2014. Much of the financing gap had been plugged with HY issuances. Energy is now the biggest sector in HY markets.

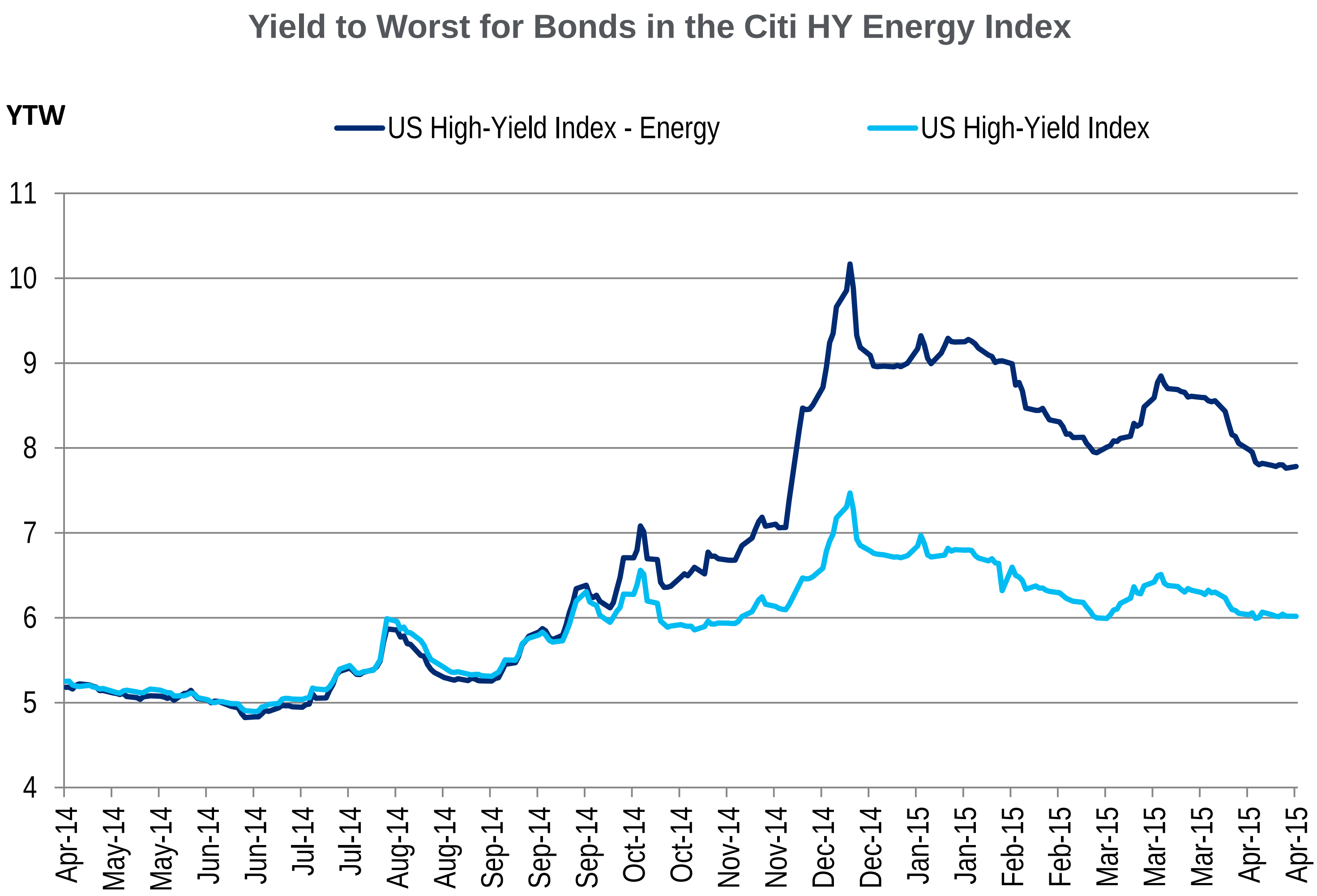
Issuance in the HY energy sector (2005-2014)



Source: Bloomberg, Citi Research

Costs of HY capital almost doubled, then recovered moderately

As oil collapsed, HY bond pricing was hit hard and the appetite for new issuances shrank. As oil has recovered from lows, so have bond prices. Though yields are still well above where the were prior to oil's collapse.



Source: YieldBook, Citi Research

Key HY energy market issues to watch

On April 16th, Citi's Credit Energy conference covered: (1) Commodity Price Outlook, (2) M&A Panel, (3) Private Equity Panel, (4) Restructuring Panel, (5) Reserve Based Lending, (6) Basin Profiles, (7) Reserve Analysis, and (8) Commodity Trading Desk Update. Key takeaways are below.

101 Change-of-Control

- The issue of 101 change-of-control in an environment where many Energy bonds are trading well below par was mentioned in multiple panels. The consensus among panelists seemed to be that acquirers would be hesitant to pay 101 for bonds trading at a deep discount (sub-$80 price), and would likely try to negotiate with holders for a lower take-out price.

Fall 2015 Borrowing Base Redetermination

- There was a lot of focus on the Fall 2015 redetermination. Most companies are exiting the Spring redetermination relatively unscathed as banks have been accommodative in a number of ways including covenant relief, approving 2nd lien financing, and holding price decks close to strip instead of building in a discount. The Fall redetermination could be more severe for some companies as hedges begin to roll off and banks build in their typical discount of ~15% to strip pricing.

M&A Disconnect

- Another major theme was M&A and the disconnect between buyers and sellers in the high-yield and distressed E&P space where we've seen limited assets exchange hands so far.

Equity Valuations

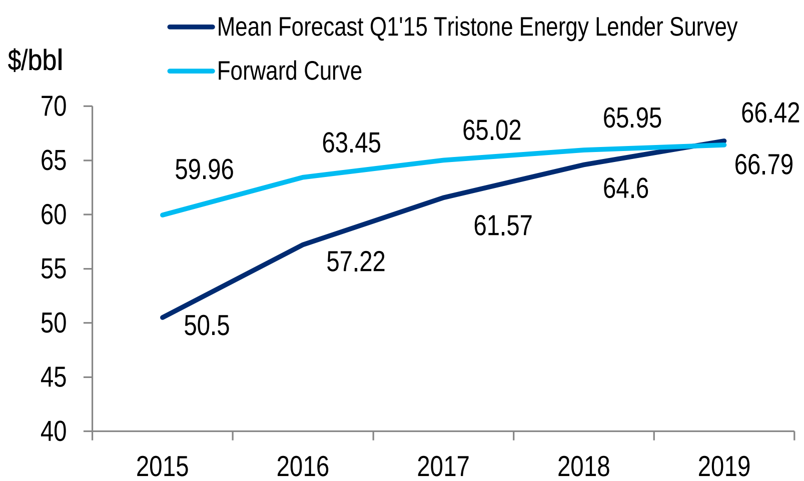
- Multiple panelists also highlighted that equity valuations in general seem to reflect above-strip commodity pricing as analysts use higher in-house price decks than the strip, which created attractive opportunities for companies to raise equity capital in 1Q15.

Source: Citi Research

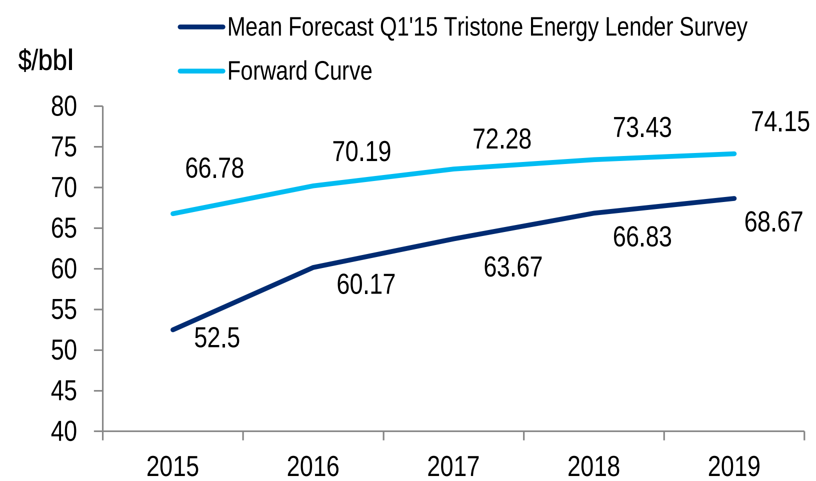
Reserve Based Lending crucial capital source for drillers, exposure for banks

RBLs are large revolvers and key funding for many drillers. The facilities are a function of reserve values, which are a function of prices. The industry is carefully watching what prices banks will assume in RBL price decks in this fall's reviews. If banks drop RBL price decks, the access to RBL liquidity could contract.

WTI Average Price Decks vs Forward Curve



Brent Average Price Decks vs Forward Curve



- RBL's are collateralized by a producer's reserves, which are valued based on bank "price decks"
- Price decks on average are down 35.7% for front-year WTI and 37.5% for front-year Brent versus 4Q'14
- Bank price decks are generally reactionary and tend to be sticky, with a delayed response to changes in spot prices. But, given the dramatic move in oil seen in 2H'14, banks had no choice but to lower price decks significantly
- A $10 price reduction in oil prices works out to about a 10-13% reduction in borrowing bases; WTI 2015 prices have fallen ~$30
- This could force impacted companies to reduce capex significantly in order to preserve liquidity

Source: Bloomberg, Tristone, Citi Research

Regional bank exposure to loans is real

Regional banks may have a higher concentration of total loans exposed to energy (5-15%) vs. national banks (2-4%). Regional banks have both direct and indirect exposure to any sustained low oil price environment. Historically, indirect exposure can be larger, as in the 1980's in TX, and should not be ignored.

- A sustained lower oil price environment could create additional risk for regional banks with energy exposure
- Hedging activity by borrowers could delay credit issues, though hedging patterns are heterogeneous across borrowers
- Banks with concentrated exposures to smaller or levered producers, oilfield services companies, and equipment manufacturers may have the most risk, though the greatest share of bank exposure is likely to E&P, according to S&P
- Direct loan exposure ranges from around 5-15% of total loans for regional banks active in energy lending
- Redeterminations of RBL borrowing basis could affect borrowers' liquidity. RBL's are collateralized by reserves.
- Banks with direct regional exposures may also have indirect regional exposures to other borrowers and asset values connected to the oil industry, such as real estate
- During the 1980's oil price collapse, in Texas, more loan losses were driven by commercial real estate write downs than by direct losses in energy

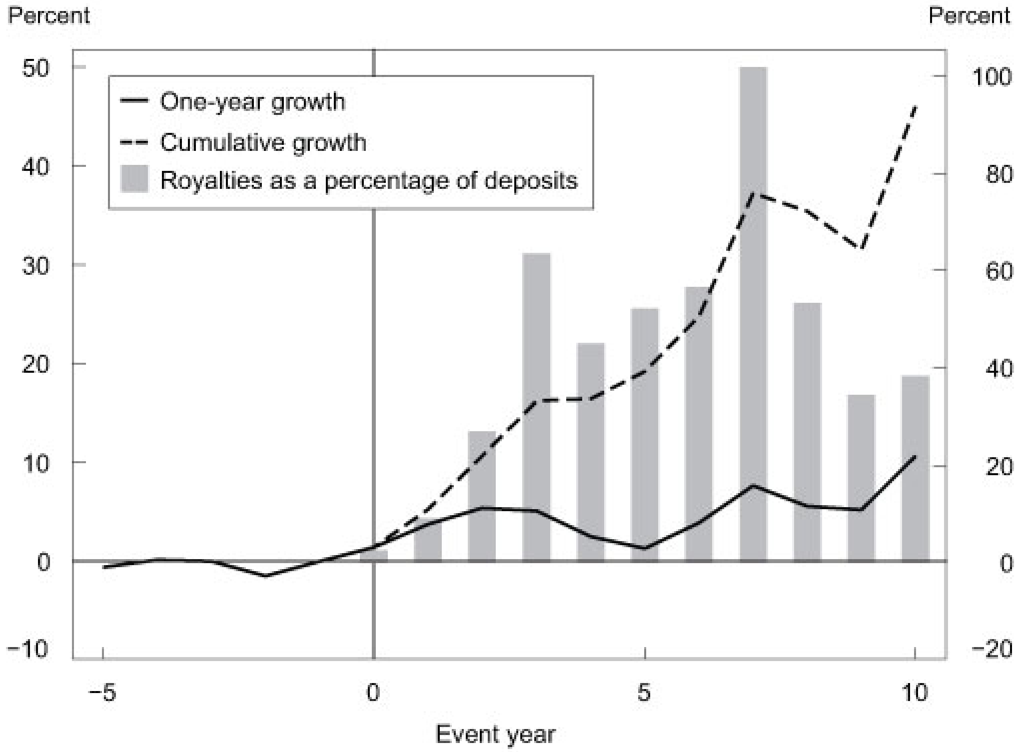
Source: S&P, Citi Research

Ramp up in drilling activity can lead to bank "deposit shocks"

On average, banks exposed to energy counties experience 4% higher deposit growth than other banks. NY Fed studies how start of royalties from drilling activity impacts the deposit profile of regional banks. Extra deposits can be broadly allocated in three ways: 1) make loans; 2) invest in liquid assets; 3) pay down other sources of financing.

From the start of drilling activity, "excess deposits" above areas without energy grow quickly (source: Poser, NY Fed)

The Average Evolution of Royalties and Excess Deposit Growth



Source: Author's calculations based on data from various state energy agencies and the Federal Deposit Insurance Corporation *Summary of Deposits*.

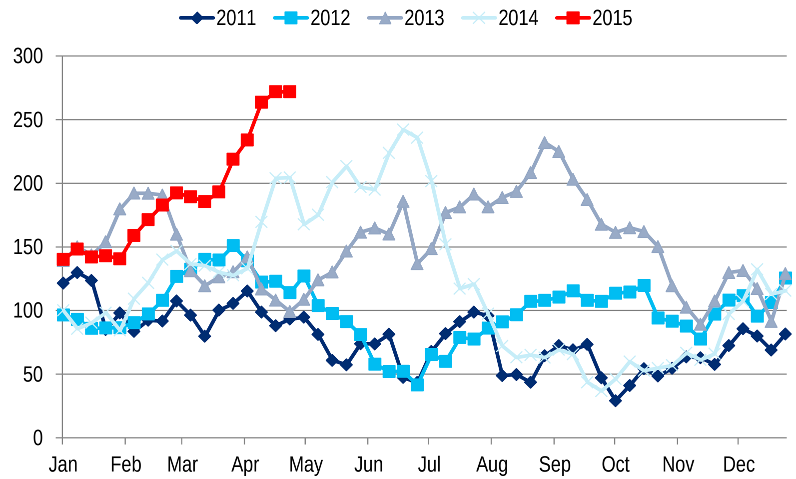
Note: Deposit growth tracks to the left y-axis; royalties track to the right y-axis.

Source: Bank Heterogeneity and Capital Allocation: Evidence from "Fracking" Shocks. Matthew C. Poser. Federal Reserve Bank of New York Staff Reports , no.693. October 2014; revised February 2015. Citi Research

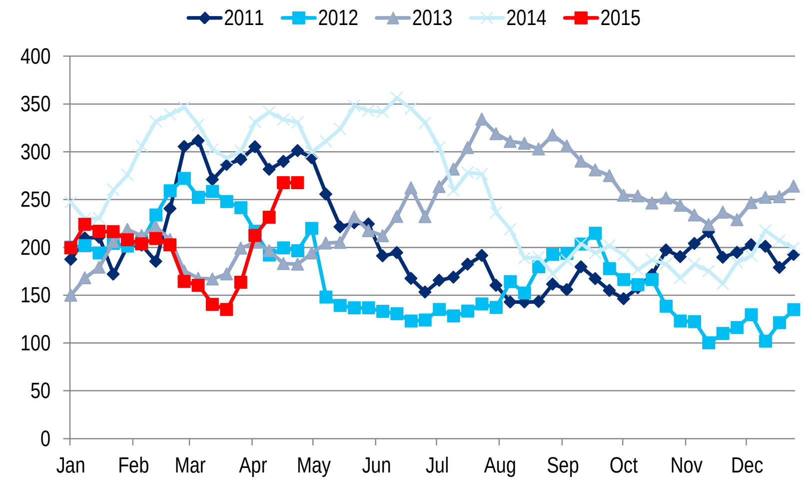
Markets have not seen the lows yet but a price rebound is likely by year-end

Combined open interest on Brent and WTI is now at all-time highs as huge inflows of financial interest have entered crude markets. These flows are helping exaggerate price moves whilst also creating some potential distortive effects, such as the big inflows in WTI ETFs despite the large negative roll yield.

Money manager net length (F&O, 000s lots) – ICE Brent



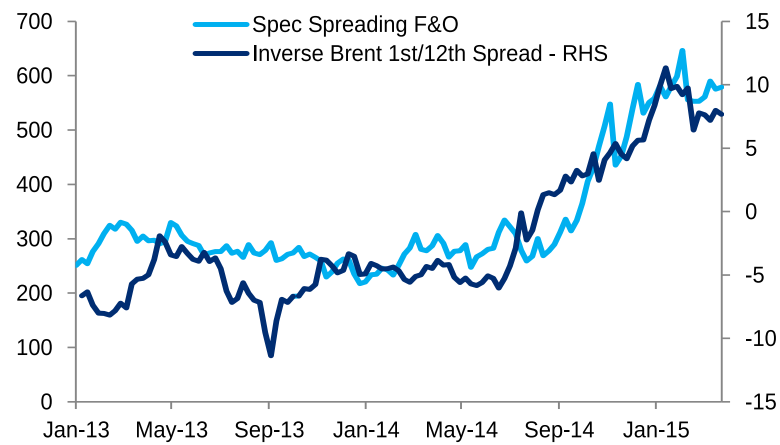
Money manager net length (F&O, 000s lots) – NYMEX WTI



Money continues to flow into crude ETFs (mln shares)

ETF	Direction	Leverage	4/28/2015	4/27/2015	d-o-d	4/21/2015	w-o-w	1/2/2015	YTD
USO	Long	1x	136.30	138.90	(2.60)	139.70	(3.40)	63.40	72.90
DBO	Long	1x	46.40	47.00	(0.60)	47.00	(0.60)	18.00	28.40
UCO	Long	2x	115.75	115.75	0.00	117.35	(1.60)	44.40	71.35
UWTI	Long	3x	240.40	240.40	0.00	234.50	5.90	21.35	219.05
OIL	Long	1x	94.09	94.09	0.00	94.08	0.00	30.66	63.43
Total			**632.94**	**636.14**	**(3.20)**	**632.63**	**0.30**	**177.81**	**455.13**

Spread positions by speculative investors on ICE Brent have pushed the curve into contango (000s lots, $/bbl)



Source: Bloomberg, CFTC, Citi Research

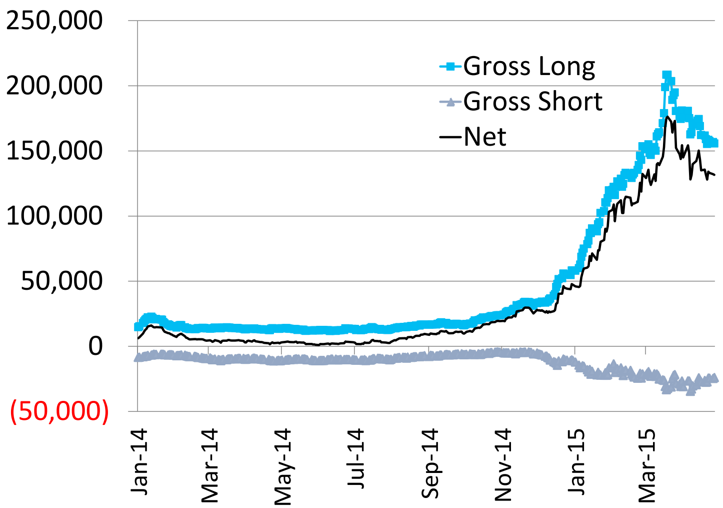
The case in point: ETF inflows buttress crude oil…

…as 'tourists,' macro funds and even sophisticated investors looked to 'call a bottom' on the crude oil price collapse, volumes and liquidity for the products skyrocketed.

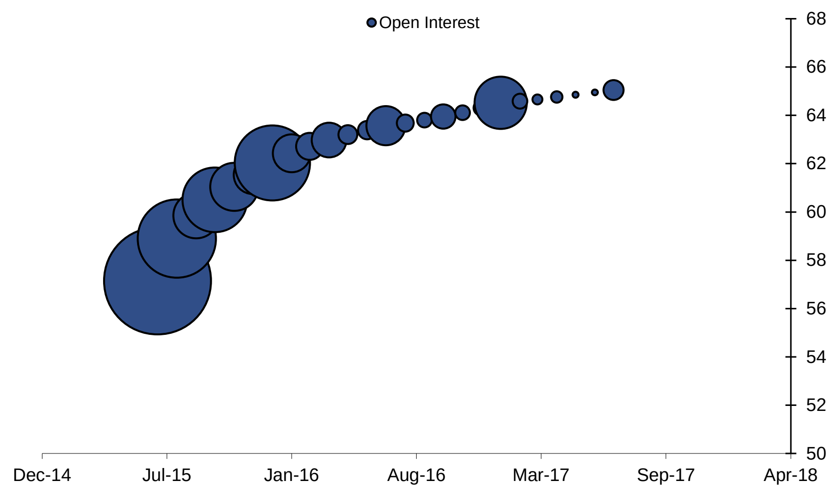
- **Crude-linked ETF inflows have created *significant* froth in oil market trading and supported, in particular, WTI flat price this year.** We would have expected US crude prices to have touched a $3-handle in 1Q absent these large product inflows. Based on NAV and change in shares outstanding data, estimated net long holdings for the largest unlevered and levered US-listed crude ETF tickers quadrupled in 1Q to a futures equivalent of c175-k lots towards end-March 2015. This represents some 5-10% of total NYMEX WTI futures, options and swaps open interest. But these exchange traded funds are primarily concentrated at the front of the curve and **represent c30-40% of prompt month open interest** (futures). While historically a negligible aspect energy market trading, the influence of oil-linked ETFs appeared outsized this year.

- **Unwinding this length could exacerbate a downside oil price correction in 2Q given the bearish physical fundamentals.** Indeed, implied net length has already started fading from the peaks into early April. Furthermore, while money invested in the unlevered funds may remain sticky, and serve as a macro portfolio hedge (for portfolios short energy equities or credit and using the ETF as an oil price hedge), the levered funds that are positioned long and represent some 20-40% of the market appear especially exposed to retrenchment should WTI prices hit a cyclical nadir in April/May.

Major US Crude Oil ETF Exposure (contract equivalent)*



NYMEX WTI Futures Curve and Open Interest by Month*



Source: Bloomberg, CFTC, Citi Research, *end 1Q'15

Geopolitics and fundamentals point to a volatile price path ahead

Global stock draws are expected by 2H'15, but then US shale can kick-start as prices rise, especially with a large backlog of drilled but uncompleted wells, although supply (and stocks) could be bottled-up in the US.

Demand	1Q15	2Q15	3Q15	4Q15	1Q16	2Q16	3Q16	4Q16	2014	2015	2016	14'	15'	16'
OECD Americas	24.1	24.0	24.5	24.5	24.0	23.9	24.4	24.4	24.0	24.3	24.2	-0.04	0.24	-0.09
OECD Europe	12.9	13.3	13.8	13.4	12.9	13.2	13.6	13.3	13.5	13.4	13.3	-0.23	-0.10	-0.10
OECD Asia	8.7	7.5	7.6	8.3	8.6	7.5	7.5	8.3	8.1	8.0	8.0	-0.20	-0.09	-0.07
OECD Demand	**45.7**	**44.8**	**45.9**	**46.3**	**45.5**	**44.5**	**45.6**	**46.0**	**45.6**	**45.7**	**45.4**	**-0.47**	**0.05**	**-0.27**
Non-OECD Demand	**47.0**	**47.9**	**48.5**	**48.7**	**48.4**	**49.3**	**49.9**	**50.1**	**46.9**	**48.0**	**49.4**	**1.15**	**1.15**	**1.37**
Total Demand	**92.8**	**92.7**	**94.3**	**95.0**	**93.9**	**93.8**	**95.4**	**96.1**	**92.5**	**93.7**	**94.8**	**0.68**	**1.20**	**1.11**
Supply	**1Q15**	**2Q15**	**3Q15**	**4Q15**	**1Q16**	**2Q16**	**3Q16**	**4Q16**	**2014**	**2015**	**2016**	**14'**	**15'**	**16'**
US	12.6	12.8	12.7	12.8	12.8	12.9	13.1	13.3	11.8	12.7	13.0	1.53	0.96	0.30
Canada	4.3	4.2	4.2	4.5	4.4	4.3	4.3	4.7	4.2	4.3	4.4	0.24	0.10	0.10
Mexico	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.8	2.7	2.6	-0.11	-0.10	-0.04
Brazil	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.3	2.4	2.5	0.18	0.09	0.09
North Sea	3.0	2.8	2.6	2.9	2.9	2.7	2.5	2.8	2.9	2.8	2.7	0.03	-0.10	-0.10
Russia	11.0	10.9	10.7	10.8	10.8	10.8	10.6	10.7	10.9	10.9	10.7	0.05	-0.07	-0.13
Other Non-OPEC	17.3	17.0	17.0	17.0	17.2	16.9	16.9	16.9	17.3	17.1	17.0	-0.13	-0.25	-0.10
Non-OPEC	**53.4**	**52.7**	**52.3**	**53.0**	**53.2**	**52.7**	**52.6**	**53.4**	**52.2**	**52.9**	**53.0**	**1.81**	**0.63**	**0.12**
OPEC Crude	30.2	30.3	30.2	30.2	30.2	30.3	30.5	30.5	30.3	30.2	30.4	-0.17	-0.06	0.15
OPEC Oil	**36.7**	**36.9**	**36.8**	**36.8**	**36.8**	**36.9**	**37.2**	**37.2**	**36.7**	**36.8**	**37.0**	**-0.04**	**0.13**	**0.22**
Processing Gains	**2.2**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.2**	**2.3**	**2.3**	**0.04**	**0.06**	**0.02**
Global Biofuels	**1.8**	**2.3**	**2.6**	**2.3**	**1.9**	**2.3**	**2.7**	**2.4**	**2.2**	**2.2**	**2.3**	**0.17**	**0.06**	**0.08**
Total Supply	**94.1**	**94.1**	**94.0**	**94.4**	**94.2**	**94.3**	**94.7**	**95.3**	**93.3**	**94.2**	**94.6**	**1.97**	**0.88**	**0.44**
Implied Stockbuild	**1.3**	**1.4**	**-0.3**	**-0.6**	**0.3**	**0.4**	**-0.7**	**-0.8**	**0.8**	**0.5**	**-0.2**	**-**	**-**	**-**
"Call on US Production"	**11.3**	**11.4**	**13.0**	**13.3**	**12.5**	**12.5**	**13.8**	**14.1**	**11.0**	**12.3**	**13.2**	**-**	**-**	**-**

Citi oil price forecast

	1Q15	2Q15	3Q15	4Q15	1Q16	2Q16	3Q16	4Q16	2014	2015	2016
Brent	55	45	55	65	67	65	70	75	100	55	69
WTI	49	35	45	57	60	56	63	66	93	47	61
Brent-WTI	6	10	10	8	7	9	7	9	7	9	8

Source: Citi Research

Appendix A-1

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