BofA SECURITIES

Global Energy Weekly

Shale shifts into low gear

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Commodities
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US shale has exceeded estimates, weighed on oil prices…

WTI and Brent crude oil prices rallied to highs of $98 and $95 in September of 2023 as long anticipated inventory draws got underway, but fundamentals quickly changed in 4Q and rising Middle East tensions were not enough to support prices. The market shifted from drawing inventories at a pace of more than 800k b/d in 3Q23 to nearly flat in 4Q23. Softening demand and underwhelming OPEC+ supply cuts contributed to price weakness, but exceptional shale growth was also to blame. At the end of 2023, US crude and liquids supply growth estimates hit 1.5mn b/d YoY, up from 1.2mn b/d in 2022. The rise in output runs counter to the decline in Brent crude oil prices, which averaged $99 in 2022 before falling to $82 in 2023. With Brent set to average $80 in 2024, a repeat of 2023 shale supply growth is unlikely. In fact, recent data point to a notable slowdown.

…driven by D&C inertia from 2022, but activity is slowing

US crude oil supply has been noisy in 2023 but has grown 550k b/d sequentially from May-October, reaching new record highs along the way. Some point to well efficiency and productivity gains as reasons for surging supply, but we believe the main driver was a lagged response to high oil prices in 2022. The US oil rig count peaked in late 2022 and has since fallen 20%, and well completions and starts generally lag the rig count due to the order of operations. Well starts lagged noticeably behind drilling activity in 2022 but started to catch up in 2023. Public E&Ps maintained their disciplined growth approach, but private producers (~35% of US onshore oil output) reverted to more aggressive pre-Covid activity trends. As of the end of 3Q23, private E&Ps grew 400-450k b/d YoY, while public E&Ps rose 250-300k b/d and majors grew at a slower pace.

US crude output to rise 1mn b/d YoY in 23, 440k b/d in 24

Upstream activity is already slowing, especially among private E&Ps who have trimmed their rig count by 40% from the 2022 peak. Public E&Ps and majors are also cutting back, albeit to a lesser degree, and the aggregate impact is likely to be a 9% reduction in US onshore D&C capex in 2024 according our oilfield service research team (see 2024 Outlook: INTL/Offshore OFS shines bright in a dark macro). We expect high single digit % declines in well starts in the oil basins and see total US crude supply growth slowing 440k b/d YoY in 2024 or 250k b/d 4Q/4Q (see Can (geo)politics Trump fundamentals?), driven primarily by the Permian. Limited PADD 2 growth, rising Permian supply, and the potential startup of TMX could drive Midland-Cushing spreads tighter this summer/fall, while tighter heavy oil balances in PADD 2-3 could boost WCS-WTI spreads at Cushing.

Exhibit 1: BofA Commodity Research Themes and Outlook

Key takeaways

	View	Recent reports
Macro outlook	■ Our economists see world GDP rising 3% in 2023 and expanding by 2.8% in 2024.	
WTI and Brent crude oil	■ We project Brent and WTI to average \$80/bbl and \$75/bbl, respectively, in 2024. ■ The global oil balance should remain in a mild surplus during 2024, as OPEC+ withholds more supply from the market to counteract slowing demand growth ■ We forecast global demand growth of 2.3mn b/d YoY in 2023 and 1.2mn b/d in 2024. ■ Non-OPEC supply should grow roughly 2.24mn b/d YoY in 2023 and 1.35mn b/d in 2024. ■ We project total US crude and NGL supply to rise 1.5mn b/d in 2023 and 700k b/d in 2024. ■ OPEC crude oil supplies are set to fall 470k b/d in 2023 and 260k b/d in 2024 as OPEC+ actively manages balances	• Can (geo)politics Trump fundamentals? 04 January 2024 • The grind of the oil bulls 26 September 2023 • Money breaks oil's back 08 May 2023 • OPEC+'s whatever it takes moment 05 April 2023 • Global Energy Paper: Medium-term oil outlook 26 February 2023
Atlantic Basin oil products	■ Refined product markets face risks from OPEC+ cuts, a looming recession, and the pace of global refining capacity growth. ■ We forecast RBOB-Brent to average \$13/bbl in 2024, and we see ULSD-Brent cracks averaging \$26/bbl over the same period. ■ OPEC+ cuts, rising complex refining capacity, lower gasoline and diesel cracks create upside for 3.5% fuel oil cracks, which we see averaging -\$12/bbl in 2024.	• Waiting for Dangot(e) 31 October 2023 • Diesel weasels out of a cyclical downturn 29 August 2023 • In the fuel oil market, high sulfur is king 31 July 2023
US natural gas	■ US gas supply and demand growth should hit 1.6Bcf/d and 2.6Bcf/d YoY in 2024, pushing stocks to 3.95Tcf by October. ■ We forecast US Henry Hub natural gas prices will average \$3/mmbtu in 2024	• US nat gas rollercoaster nears the bottom 17 February 2023
LNG	■ LNG supply growth is manageable from historical view at 10MMT in 24 and 16MMT in 25, leaving demand to dictate future price path ■ JKM and TTF should average \$15/MMBtu and €50/MWh in 2024, but they could easily hit \$25/mmbtu or €100/MWh on cold weather	• Liquid gas can float and fly. So can oil 17 October 2023 • LNG is now a buyer's market 17 April 2023
Thermal coal	■ Seaborne coal prices pulled back on softer balances. Yet, China has come back in earnest, more than doubling thermal coal imports ■ We are constructive in 2024 on strong Asian demand and declining Russian supply	• China coal floors global gas 05 September 2023 • King coal loses its crown 31 March 2023

Source: BofA Global Research estimates

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Exhibit 2: BofA Global Research Commodity Price Forecasts

(period averages)

	units	1Q23F	2Q23F	3Q23F	4Q23F	2023F	1Q24F	2Q24F	3Q24F	4Q24F	2024F
WTI Crude Oil	(\$/bbl)	76	74	82	82	78	73	75	77	75	75
Brent Crude Oil	(\$/bbl)	82	78	86	86	83	78	80	82	80	80
US NY Harbor ULSD (HO) Cracks to Brent Crude Oil	(\$/bbl)	41	25	40	37	36	30	25	25	25	26
US RBOB Cracks to Brent Crude Oil	(\$/bbl)	23	31	29	7	22	11	21	14	7	13
NWE Low Sulphur Gasoil Cracks to Brent Crude Oil	(\$/bbl)	31	17	32	29	27	23	20	20	19	21
NWE Eurobob Cracks to Brent Crude Oil	(\$/bbl)	15	22	27	7	18	5	14	10	3	8
NWE 1% Residual Cracks to Brent Crude Oil	(\$/bbl)	-13	-8	-3	-7	-8	-6	-5	-5	-5	-5
NWE 0.5% Residual Cracks to Brent Crude Oil	(\$/bbl)	2	2	4	3	3	2	2	2	2	2
NWE 3.5% Residual Cracks to Brent Crude Oil	(\$/bbl)	-23	-11	-4	-14	-13	-13	-12	-12	-12	-12
US Natural Gas	(\$/MMBtu)	2.74	2.32	2.66	3.15	2.72	2.90	2.50	3.00	3.60	3.00
Thermal coal, Newcastle FOB	(\$/t)	253	160	147	145	176	148	148	151	153	150
Aluminium	\$/t	2,401	2,260	2,160	2,250	2,268	2,250	2,500	2,750	2,750	2,563
Copper	\$/t	8,941	8,461	8,367	8,000	8,442	8,000	8,500	8,750	9,250	8,625
Lead	\$/t	2,137	2,118	2,171	2,200	2,156	2,000	2,000	2,000	2,000	2,000
Nickel	\$/t	25,973	22,277	20,392	18,500	21,786	18,500	18,500	19,000	19,000	18,750
Zinc	\$/t	3,132	2,527	2,435	2,500	2,648	2,500	2,500	2,250	2,250	2,375
Gold	\$/oz	1892	1977	1927	1900	1924	1950	1950	2000	2000	1975
Silver	\$/oz	23	24	24	23	23	23	23	24	24	23
Platinum	\$/oz	995	1,027	932	950	976	1,000	1,000	1,100	1,100	750
Palladium	\$/oz	1,568	1,445	1,254	1,250	1,379	900	800	700	600	750

Source: BofA Global Research estimates

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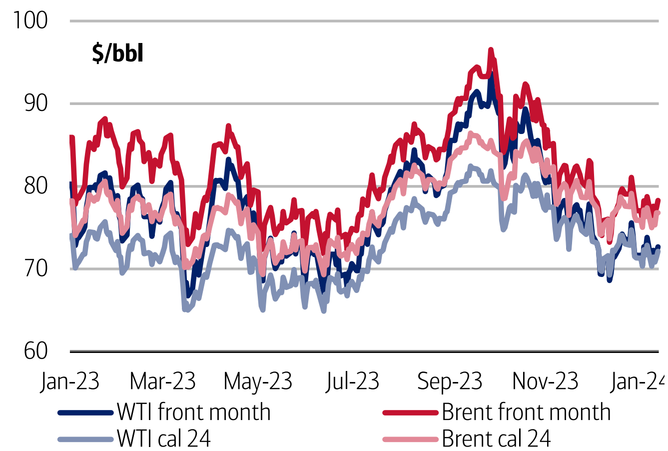
Shale shifts into low gear

Oil prices have fallen roughly 20% from their 3Q23 peak…

WTI and Brent crude oil prices peaked at $98 and $95 in September of 2023 as long anticipated inventory draws got underway and received additional support in October on the back of rising tensions in the Middle East, which spurred supply loss concerns (Exhibit 3). Since then, prices have been mostly on a downward trajectory, as a softening macro backdrop, rising shale production, and a reversal of inventory draws emerged. Brent and WTI crude oil prices are now down more than 20% from the peak. Furthermore, backwardation in the forward curves for both benchmarks has weakened dramatically (Exhibit 4), with WTI 1-3 spreads trading in contango since November.

Exhibit 3: Crude oil prices

Since peaking in 3Q23, oil prices have been in a downward trajectory, driven by a softer macro backdrop, rising shale production, and rising inventories



Source: Bloomberg

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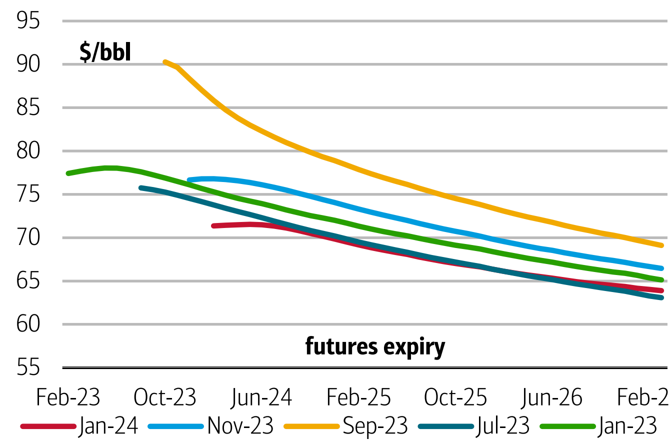
Exhibit 4: WTI forward curve

Backwardation in the forward curves for both benchmarks has weakened dramatically with WTI 1-3 spreads trading in contango since November



Source: Bloomberg

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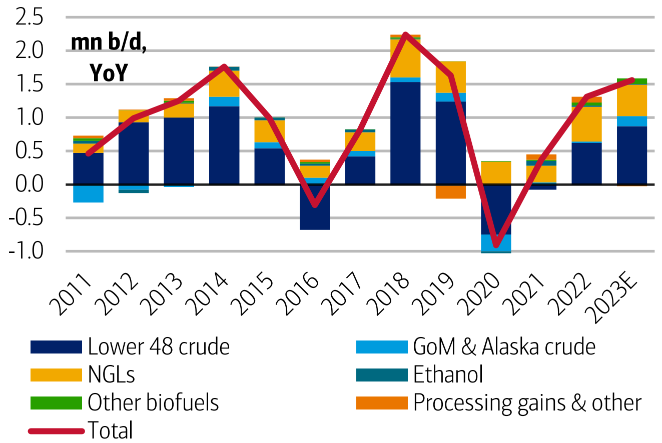
…driven by soaring US oil production, among other factors

US shale producers have worked hard to change their image in recent years, reining in ambitious capex and growth plans in favor of shareholder returns and moderate supply growth. 2022 appeared to confirm this trend, with crude oil supply growth registering around 600k b/d YoY (Exhibit 5). Lower prices in 2023 and a general slowdown in drilling activity allowed the market to maintain its assumption that US shale wouldn't destabilize the oil market like it had on multiple occasions during the 2010s. However, in recent months supply growth started to tick higher once again and crude oil growth is now likely to reach about 1mn b/d, which combined with strong NGL and biofuel growth, is set to boost US petroleum and other liquid supply by roughly 1.5mn b/d this year. Soaring US supply, coupled with rising supply elsewhere and slowing demand caused balances to deteriorate and inventories to begin building in 4Q24 (Exhibit 6). The reversal of 3Q23 inventory draws during 4Q23 has weighed on prices even as geopolitical tensions flared.

Exhibit 5: US petroleum and liquids supply growth
US petroleum and other liquid supply is set to grow by roughly 1.5mn b/d this year



Source: EIA

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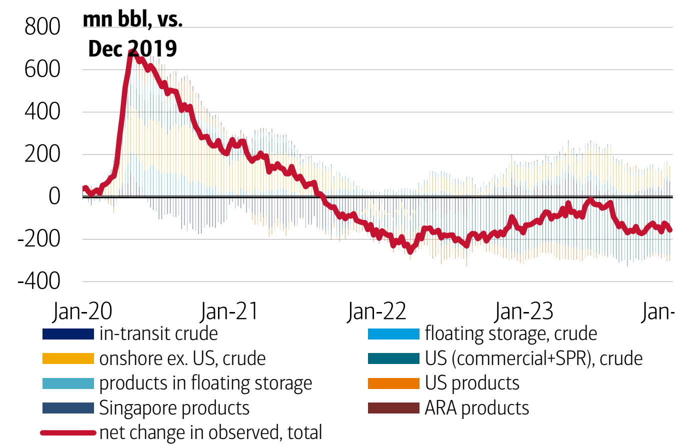
Exhibit 6: Observed change in petroleum inventories
Soaring US supply, coupled with rising supply elsewhere and slowing demand caused balances to deteriorate in 4Q24



Source: Kayrros, Bloomberg, Clarksons, BofA Global Research

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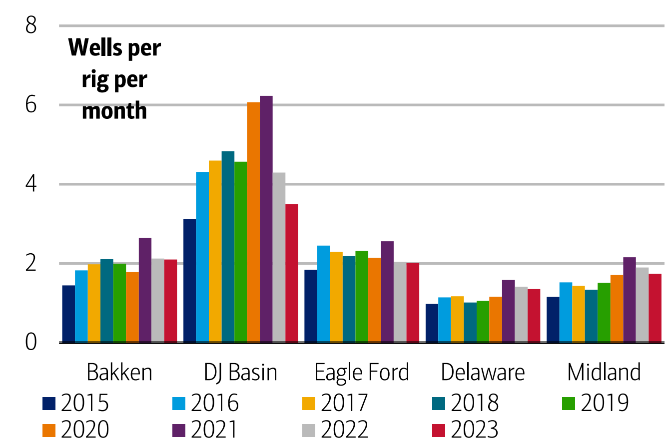
Some observers attribute recent shale growth to rising efficiency, …

One defining feature of shale wells is their accelerated decline rates, which can be upwards of 70%+ in the first year. To sustain and grow output in the shale basins, producers must constantly drill new wells, a dynamic that has allowed E&Ps and oil field service companies to iterate, modify, and optimize well design and become more efficient along the way. One of the most obvious signs of efficiency and technological innovation is the pace of drilling. The number of wells drilled per month per rig rose fairly steadily across the oil basins through 2021, but this trend has reversed in 2022 and 2023 (Exhibit 7). The slowdown is partly explained by the need to bring more inexperienced crews into the field in the past two years as drilling demand increased in response to rising oil prices. Less experienced crews typically contributed to slower drilling activity, which may explain the dip in feet drilled per day during 2022 and early 2023 (Exhibit 8).

Exhibit 7: Horizontal wells drilled per month per rig
The number of wells drilled per month per rig rose during 2015-21, but this trend has reversed in 2022 and 2023



Source: Rystad Energy

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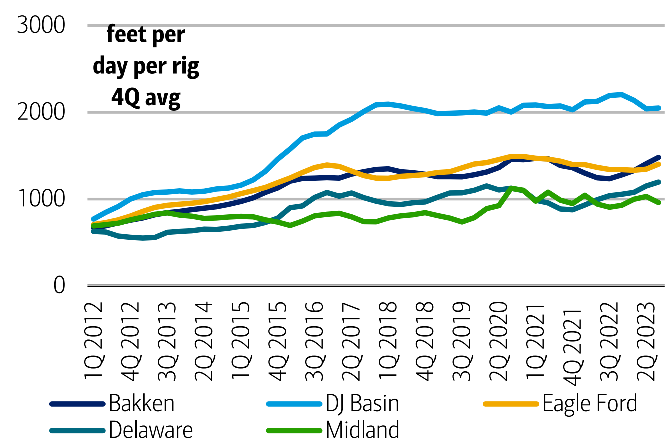
Exhibit 8: Horizontal feet drilled per day per rig by basin
Less experienced crews typically contributed to slower drilling activity, which may explain the dip in feet drilled per day during 2022 and early 2023



Source: Rystad Energy

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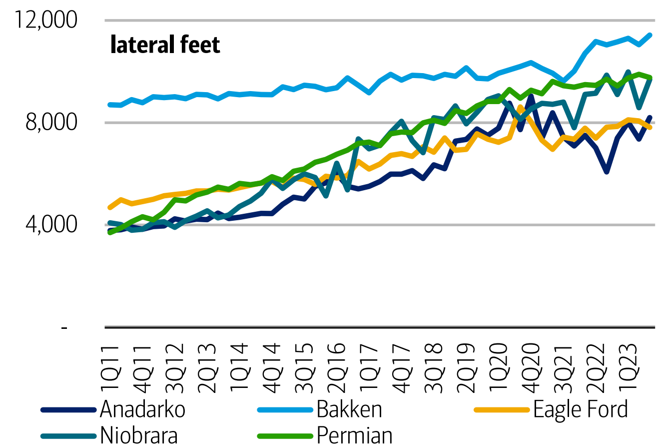
…longer laterals, and increased well productivity

One of the easiest ways for producers to boost well productivity has been to increase the size of wells by drilling longer laterals. Wells in the Bakken have always been relatively long, but wells in other basins have caught up over the past decade (Exhibit 9).

Since 2011, the lateral length of wells in the Permian has more than doubled from roughly 4,000 feet to nearly 10,000 feet in recent quarters. Other areas of focus for boosting well productivity included frac spacing and intensity and well spacing. Proppant usage per foot, an indicator of the intensity and number of fracs per well, rose across most basins through 2018, but the pace of growth has either slowed or flatlined since then (Exhibit 10), suggesting that proppant intensity has been more or less optimized.

Exhibit 9: Average US horizontal oil well lateral lengths by basin
Wells in the Bakken have always been relatively long, but wells in other basins have caught up over the past decade



Source: Rystad Energy

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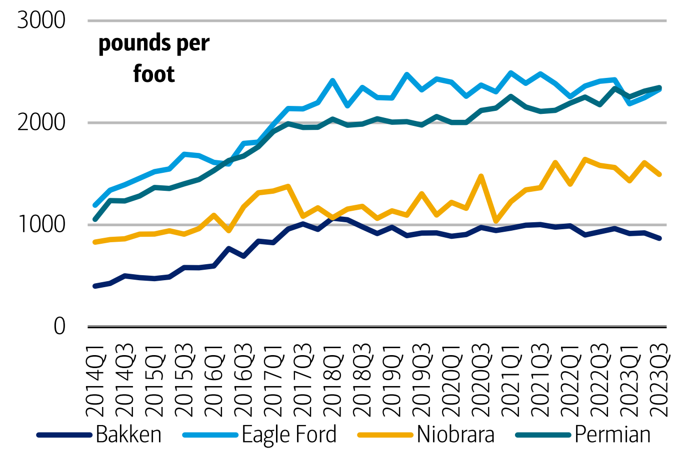
Exhibit 10: US horizontal shale well oil proppant usage
Proppant usage per foot, an indicator of the intensity and number of fracs per well, rose across most basins through 2018 but has slowed since



Source: Rystad Energy

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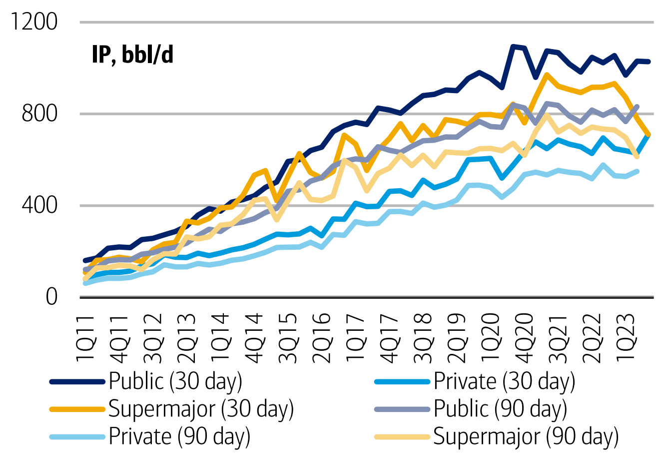
While these factors likely contributed to US growth…

Well productivity is measured in a variety of ways, and one of the most commonly recognized is the rate of initial production or IP, which can be measured over a variety of time horizons. The productivity of oil wells, measured using IP rates, shows a steady improvement from 2011 to 2020 across all producers (Exhibit 11), but the pace of improvement has either slowed significantly or stagnated since then, implying that well productivity likely did not play the main role in the recent surge. A look at performance across different basins suggests that only the Eagle Ford has seen material improvement recently, but this rise follows a steady decline during 2021-22 (Exhibit 12).

Exhibit 11: US horizontal shale well oil IPs by company type
The productivity of oil wells, measured using IP rates, shows a steady improvement from 2011 to 2020 but improvement has slowed since then



Note: includes horizontal wells in the Bakken, Eagle Ford, Niobrara, and Permian. Source: Rystad Energy

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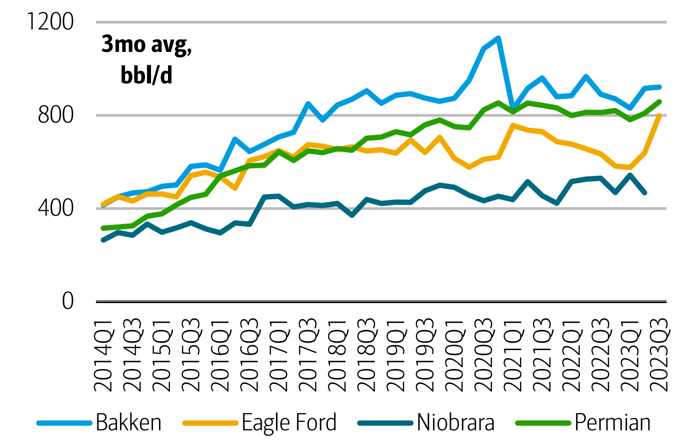
Exhibit 12: US horizontal shale well oil IPs (3mo avg)
A look at performance across different basins suggests that only Eagle Ford 3 month IPs have seen material improvement recently



Source: Rystad Energy

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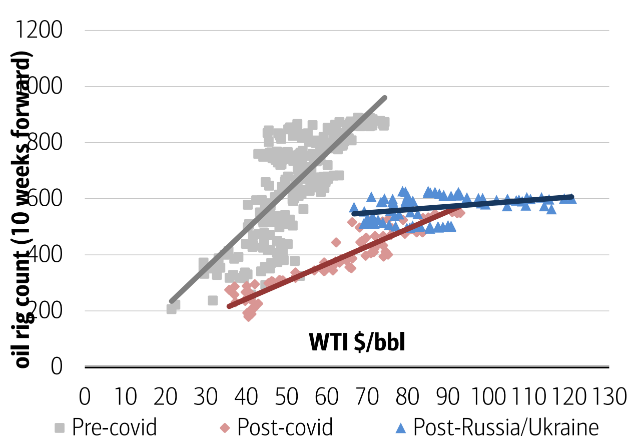
…another factor was shale's delayed response to high prices in 2022

The pace of upstream activity is unsurprisingly crucial in determining oil production growth. Shale producers were slower to add rigs in the aftermath of the pandemic (Exhibit 13), a reflection of a more disciplined approach to growth but also a result of the drilled but uncompleted well backlog accumulated during the early days of the pandemic. Rig additions were even less sensitive to higher prices following the war in Ukraine, which suggested that producers were nearly unresponsive to rising prices. In fact, this was not the case as wells drilled rose steadily into 2H22 before slowing again in 2023, alongside the decline in rig counts. Typically, wells are completed and put-on-production several months after the well is drilled because most wells are part of a pad design. As a result, well starts peaked long after oil prices had crashed from their mid-2022 highs (Exhibit 14), leading to a production surge during 2023.

Exhibit 13: US oil rig count and WTI oil prices
Rig additions were less sensitive to prices following the Ukraine war, which superficially suggested that E&Ps were nearly unresponsive to rising prices…



Source: Bloomberg

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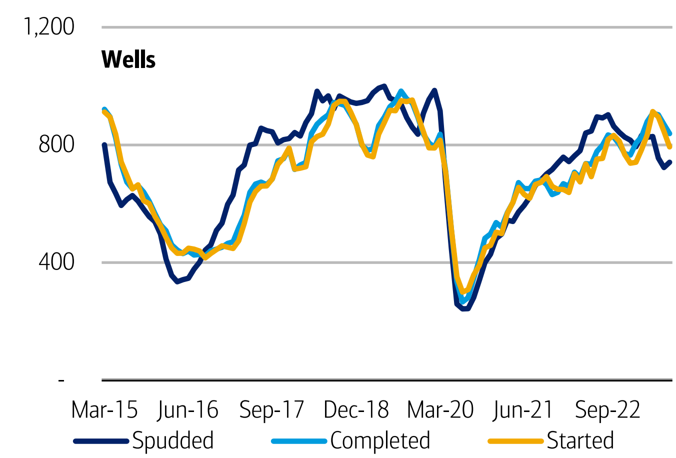
Exhibit 14: Wells spudded, completed, and started in major oil basins
…as a result, well starts peaked long after oil prices had crashed from their mid-2022 highs, leading to a production surge during 2023



Note: includes horizontal wells in the Bakken, Eagle Ford, Niobrara, and Permian. Source: Rystad Energy

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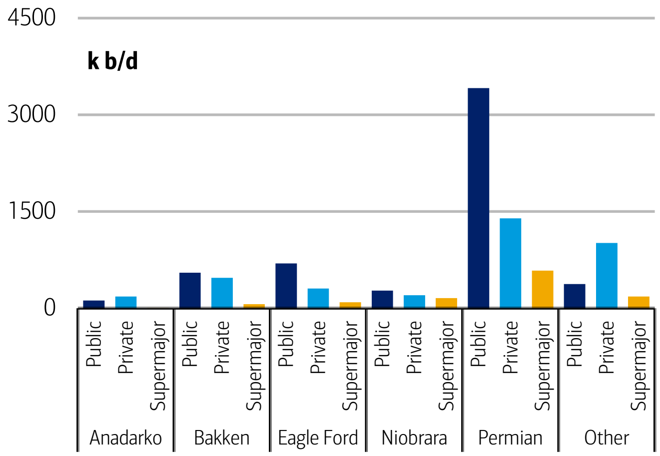
In 2023, private E&Ps disproportionately contributed to growth…

Splitting US producers into three buckets, private E&Ps, public E&Ps, and majors, helps explain activity in the shale patch. Majors view their shale assets as part of a broader portfolio and have in recent years grown their shale production to help offset declining output elsewhere in their portfolio. As a result, their drilling and completion activity is less sensitive to oil prices than public or private E&Ps. Different motives for public E&Ps (typically appeasing shareholders) and private E&Ps (typically growing and selling their company) leads to the former being less sensitive to oil prices than the latter. In 2022, public E&Ps, private E&Ps, and majors accounted for 54%, 35%, and 11% of total US onshore oil production. Public E&Ps account for a large majority of Permian output, while the split is more balanced across the rest of the US (Exhibit 15). August and September estimates suggest private E&Ps grew 400-450k b/d YoY, while public E&Ps rose 250-300k b/d (Exhibit 16) and majors grew at a slower pace.

Exhibit 15: US onshore oil production by basin (2022)
In 2022, public E&Ps, private E&Ps, and majors accounted for 54%, 35%, and 11% of total US onshore oil production



Source: Rystad Energy

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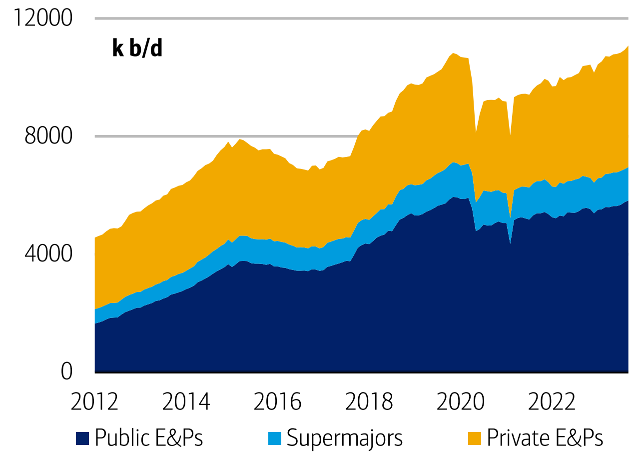
Exhibit 16: US onshore oil production
August and September estimates point to private E&Ps grew 400-450k b/d YoY, while public E&Ps rose 250-300k b/d and majors grew at a slower pace



Source: Rystad Energy

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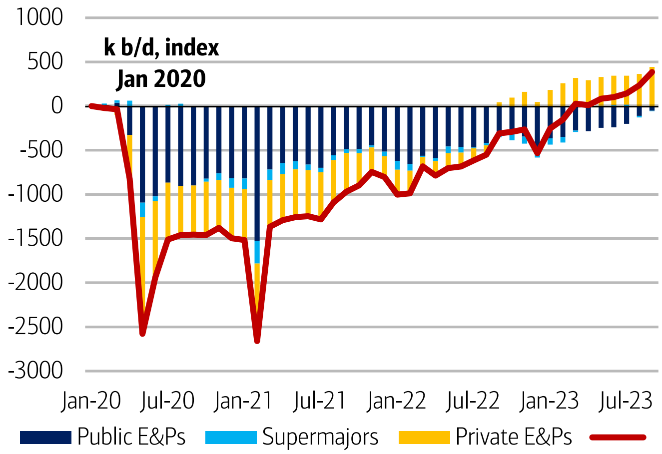
…which has been driven by basins like the Permian and the Bakken

US oil production has recovered steadily since troughing in 1H20 (Exhibit 17), save for a temporary drop in supply related to winter storm Uri in 2021 (Exhibit 18). Public E&Ps and supermajors have been slowly bringing production back to pre-Covid levels, while private oil producers have grown output by nearly 400k b/d over the same period. Nearly all private E&P supply growth has been driven by the Permian, where the group's production is up more than 500k b/d. Elsewhere, the recovery in production is still ongoing.

Exhibit 17: Cumulative US onshore crude oil supply growth since January 2020
Private E&Ps are producing more oil than before the pandemic, while public companies are still recovering



Source: Rystad Energy

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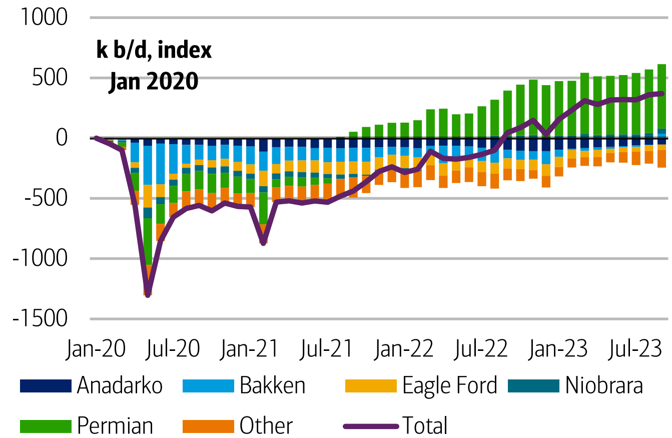
Exhibit 18: Cumulative US onshore crude oil production growth by private E&Ps since January 2020
Private E&P production growth has been dominated by the Permian basin, while other basins have lagged behind



Source: Rystad Energy

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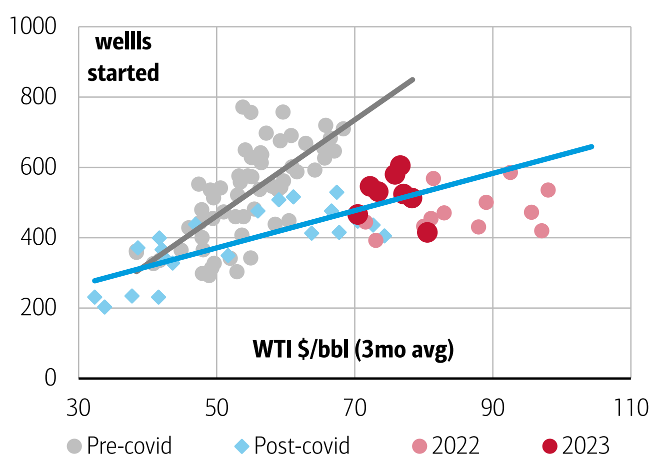
In 2023, private E&Ps exhibited activity similar to pre-Covid trends

All US oil producers became less sensitive to oil prices in the aftermath of the pandemic, but the degree of desensitization depended on the company. Public E&Ps and majors brought on fewer wells in 2022 than previous post-Covid trends (2020-21) would have suggested but well starts re-aligned with these trends in 2023. Data on private E&Ps point to more noise in their activity during 2022 (Exhibit 19), but activity appeared more closely aligned with post-Covid trends on average. However, private E&Ps brought wells online in 2023 at a pace consistent with pre-Covid trends (Exhibit 20). We view this is a lagged response to the rapid rise in oil prices and a pace of activity that will be difficult to repeat in 2024, especially because drilling activity has declined substantially.

Exhibit 19: Public E&P and supermajor oil well starts and oil prices
Data on private E&Ps point to more noise in their activity during 2022, but activity appeared more closely aligned with post-Covid trends on average



Note: includes horizontal wells in the Bakken, Eagle Ford, Niobrara, and Permian. **Source:** Rystad Energy, Bloomberg, BofA Global Research estimates

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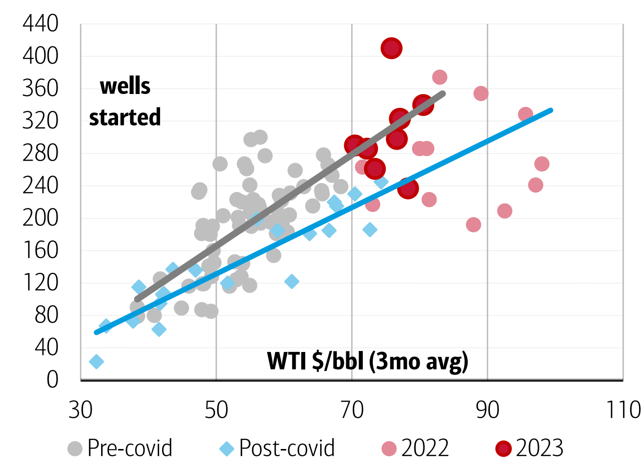
Exhibit 20: Private E&P oil well starts and oil prices
private E&Ps brought wells online in 2023 at a pace consistent with pre-Covid trends



Note: includes horizontal wells in the Bakken, Eagle Ford, Niobrara, and Permian. **Source:** Rystad Energy, Bloomberg, BofA Global Research estimates

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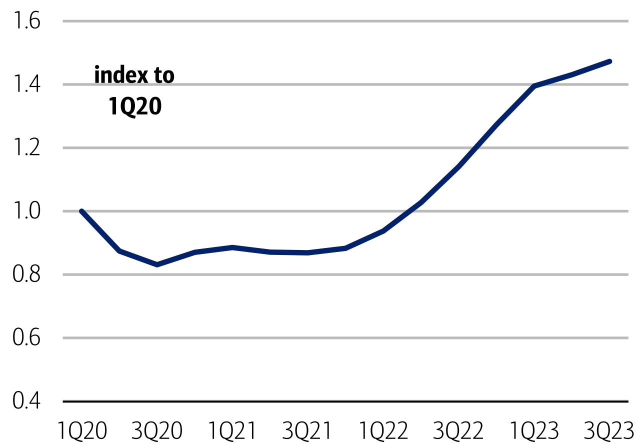
Although E&Ps could enjoy some service cost deflation in 2024…

Average rig dayrates have risen steadily since late 2021 as drilling demand increased and as OFS input costs rose. In 3Q23, the average rig dayrate was estimated to have been between 65-70% higher than 4Q21 levels, and although prices may ease due to falling demand, rising input costs are likely to keep rig cost deflation in check (Exhibit 21). Pressure pumping costs also increased since 2021, with costs rising closer to 50% in 3Q23 versus 4Q21 levels (Exhibit 22). Pressure pumping costs peaked in 2Q and have already started to roll over, but even here, price relief is likely constrained by rising input costs for pumping companies.

Exhibit 21: Estimated average rig dayrates
In 3Q23, the average rig dayrate was estimated to be 65-70% higher than 4Q21 levels



Source: HP, PTEN, BofA Global Research estimates

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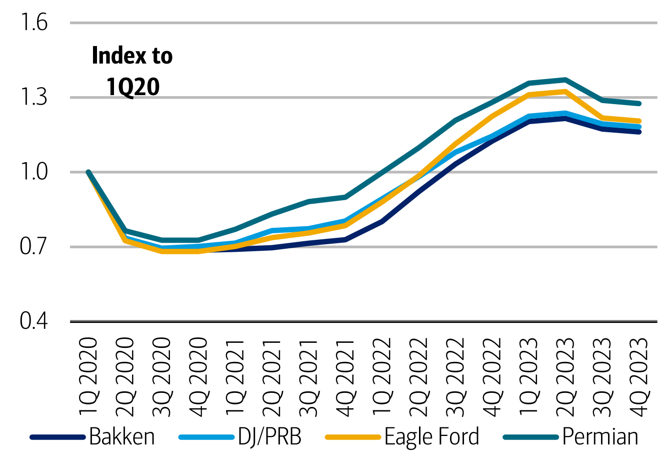
Exhibit 22: Rystad pumping hour price index
Pressure pumping costs also increased since 2021, with costs rising closer to 50% in 3Q23 versus 4Q21 levels



Source: Rystad Energy

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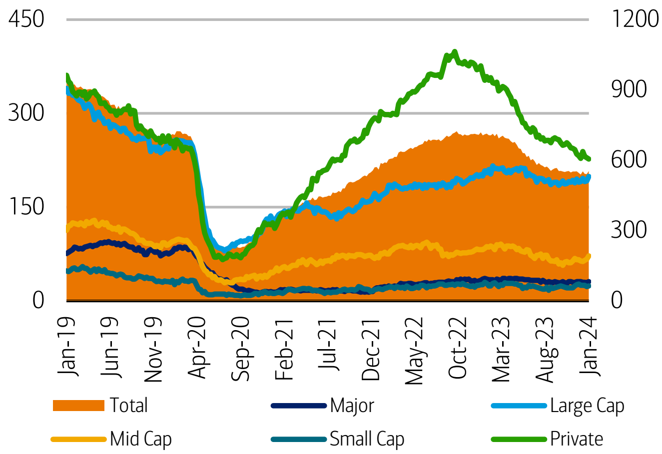
…they are likely to pull back on spending activity, led by privates

In response to the decline in prices since 2022, the US rig count has been steadily falling since early 2023, with private E&Ps driving most of the decline in rig demand (Exhibit 23). Indeed, the private E&P rig count has fallen roughly 40% from the highs of 2022, while publics and majors have seen their rig count decline between 10-20%. Completion activity has also slowed, with the number of frac spreads already 17% lower YoY for oil basins (Exhibit 24). The decline in frac spreads was led by public E&Ps and majors (-20% yoy), while private producers have only dropped 10%, suggesting there is room for private E&Ps to drop frac spreads in the future to catch up to rig activity.

Exhibit 23: US Land Horizontal Rig Count by Operator Type, Jan '19 – Current
The private E&P rig count has dropped 40% from the peak of 2022



Source: Enverus, BofA Global Research

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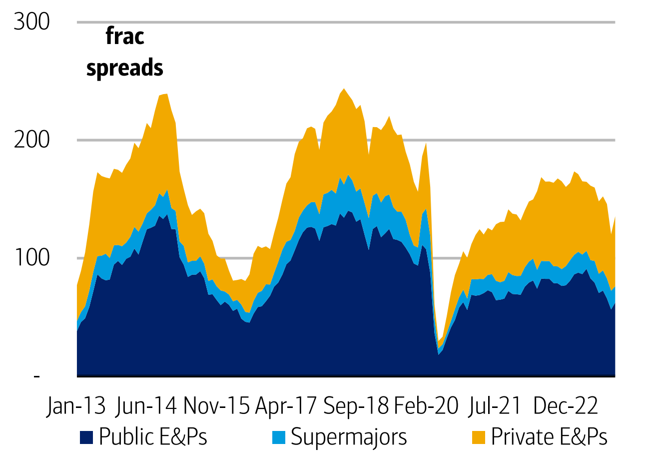
Exhibit 24: US frac spread count by company type
Completion activity has also slowed, with the number of frac spreads already 17% lower YoY for oil basins



Note: includes horizontal wells in the Bakken, Eagle Ford, Niobrara, and Permian. Source: Rystad Energy

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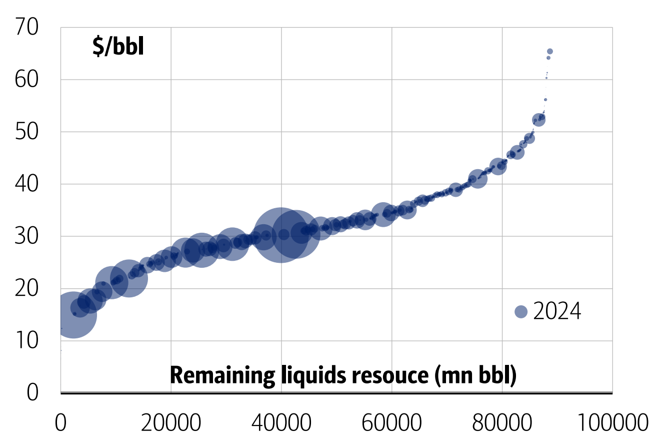
Afterall, private E&Ps have the worst economics on average

For most of the 2010s, the cost curve for tight oil has dropped as producers benefitted from efficiency and productivity improvements and a drop in OFS service costs (versus 2014 levels). Now, much of the tight oil resource base breaks even below $40/bbl (Exhibit 25), according to Woodmac, creating very profitable half-cycle economics for nearly all US tight oil assets. That said, profitability varies by company type. Private E&Ps have the poorest economics on average in the oil patch, according to Rystad (Exhibit 26), which strengthens the argument that they will slow more in the current lower price environment.

Exhibit 25: US tight oil cost curve
Much of the US tight oil resource base breaks even below $40/bbl on a half-cycle basis, according to Woodmac data



Note: assumed 15% cost of capital. Source: Rystad Energy

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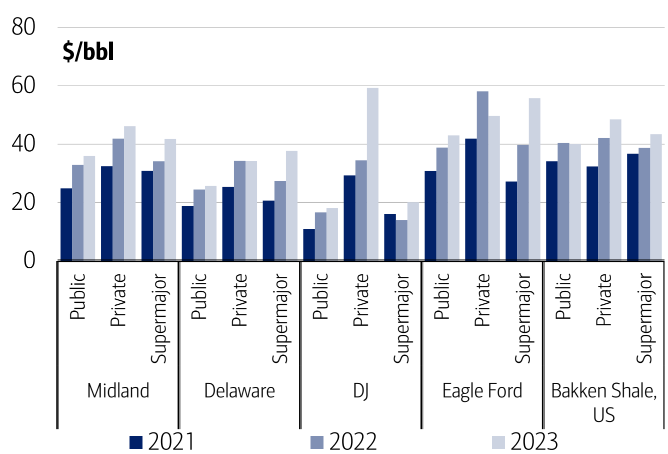
Exhibit 26: US horizontal wellhead oil breakevens
Private E&Ps have the poorest economics on average in the oil patch, which helps explain why they have pulled back more than other companies recently



Source: Rystad Energy

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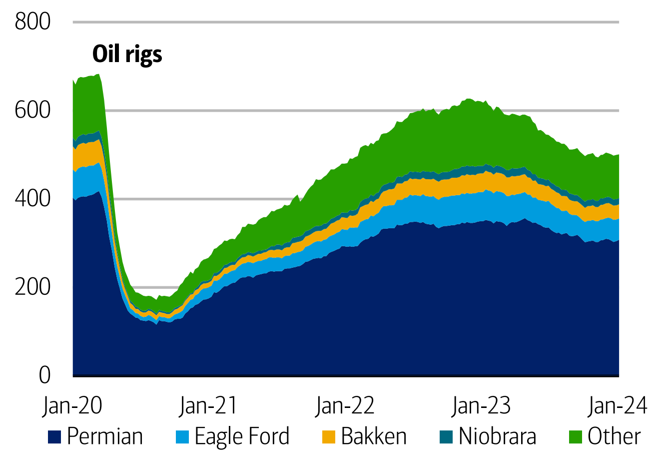
D&C activity is likely to fall most in the Bakken, Niobrara, and Eagle Ford…

The US upstream is clearly showing signs of slowing, but some basins are likely to feel the pain more than others. Rig counts in the Eagle Ford, Niobrara, and Bakken have already fallen 27%, 24%, and 18% YoY as of early January (Exhibit 27). Meanwhile, activity in the Permian has held up better, dropping just 12%. Outside the major oil basins, the rig count has fallen more than 30%, driven partly by the slowdown in gas activity. In aggregate, our oilfield service equity research team expects drilling and completion spending to fall roughly 9% YoY in 2024 (Exhibit 28) (see 2024 Outlook: INTL/Offshore OFS shines bright in a dark macro).

Exhibit 27: US oil rigs by basin

Rig counts in the Eagle Ford, Niobrara, and Bakken have fallen 27%, 24%, and 18% YoY as of early January



Source: Baker Hughes

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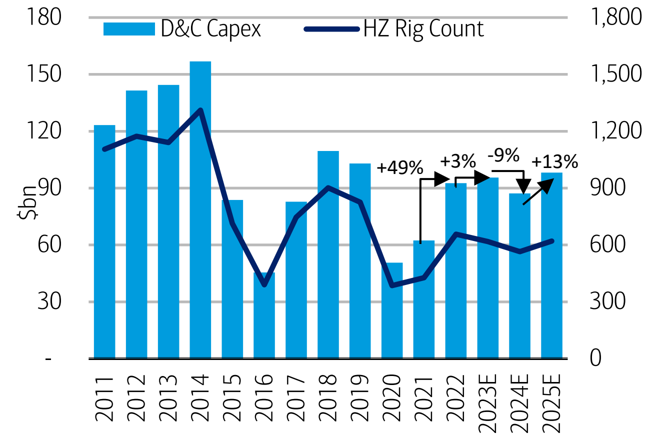
Exhibit 28: US Land Drilling & Completion (D&C) capex, 2011-25E

Our OFS equity research team see US Land D&C spending falling 9% YoY in 2024 and then growing 13% YoY in 2025



Source: Baker Hughes, Rystad, BofA Global Research estimates

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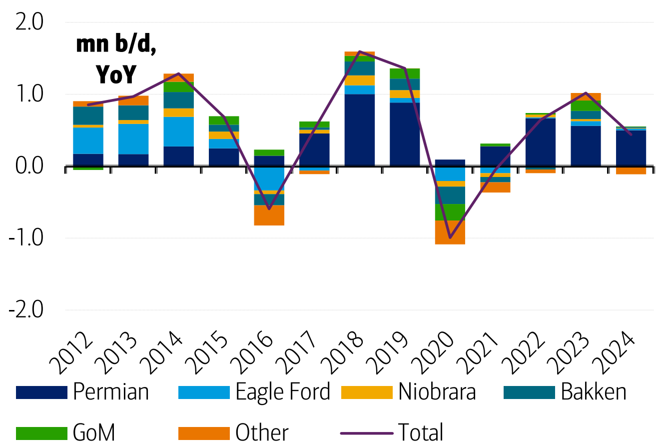
…which means slower production growth led primarily by the Permian

After rising roughly 1mn b/d in 2023, slowing upstream activity should lead to lower growth in 2024. A high single digit decline in well starts YoY across the major oil basins should lead to total US crude oil production growth of just 440k b/d this year, driven primarily by the Permian (Exhibit 29). The annual average growth rate masks the actual slowdown in activity which should lead to exit-to-exit growth of just 250k b/d, with production topping out around 13.5mn b/d (Exhibit 30).

Exhibit 29: US crude oil production growth

A high single digit decline in well starts YoY across the major oil basins should lower total US crude oil supply growth to 440k b/d on average…



Source: EIA, Rystad Energy, BofA Global Research estimates

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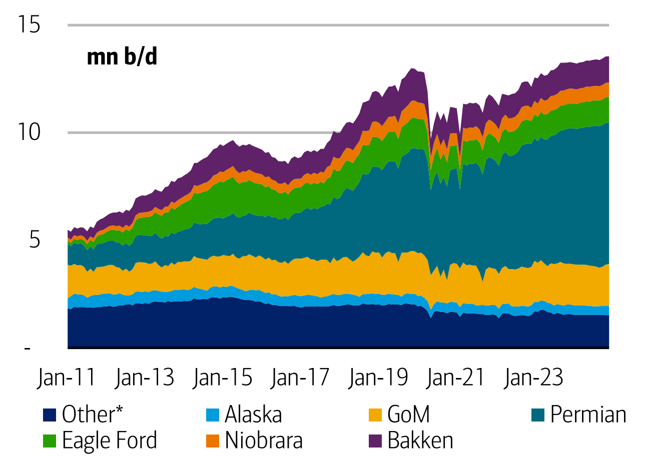
Exhibit 30: US crude oil production

…this year, leading to an exit-to-exit growth rate of about 250k b/d, with production topping out around 13.5mn b/d



Source: EIA, Rystad Energy, BofA Global Research estimates

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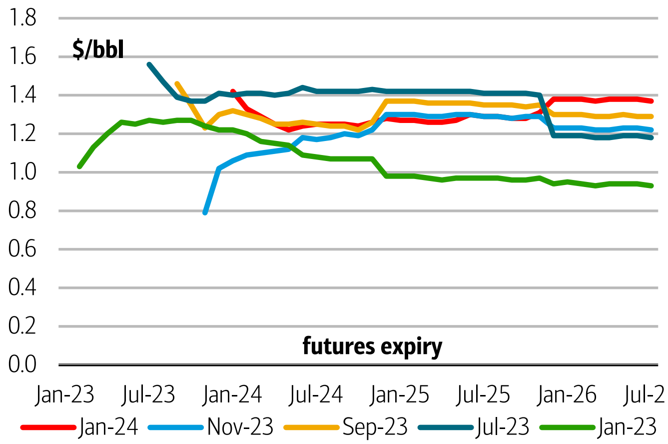
Slower growth, changing pipeline dynamics to weigh on Midland boost WCS

We see several implications from slowing US production growth and changes to pipeline takeaway capacity across North America. First, continued growth in Permian and mostly full pipelines Corpus Christi means more barrels will need to flow to Houston and Nederland, which could weigh further on Midland-MEH differentials. Meanwhile, limited growth in PADD 2 and the possible startup of Canada's Westcoast-bound TMX pipeline in 1H24 have the potential to tighten up Cushing balances to the point where Midland-

Cushing spreads must narrow to attract Permian barrels to Oklahoma (see High in the Rocky Mountains, Low on the Oklahoma Plains). This presents downside risk to the Midland-WTI forward curve for the remainder of 2024 (Exhibit 31). Furthermore, a tighter heavy oil balance in the US Midcon and USGC due to rerouted heavy barrels and our expectation for continued OPEC+ cuts should lead to upside for WCS (Cushing) vs WTI (Cushing) this summer and potentially later (Exhibit 32).

Exhibit 31: Midland – Cushing WTI forward curve

Rising Permian supply, limited new takeaway capacity and a potential TMX startup creates downside risk for Midland-WTI for the remainder of 2024



Source: Bloomberg

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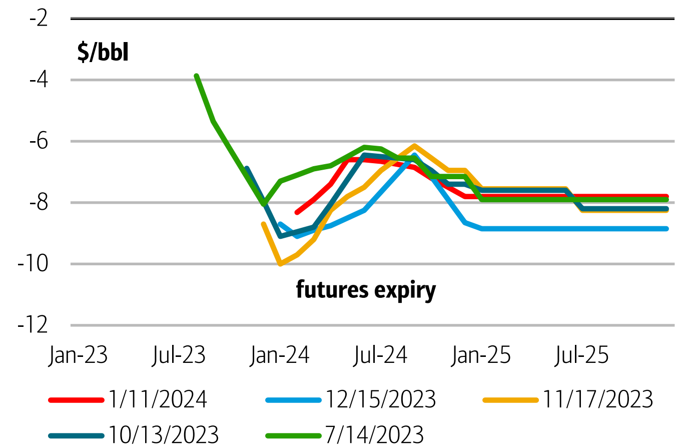
Exhibit 32: WCS (Cushing) - WTI (Cushing) forward curve

The startup of TMX and continued OPEC+ cuts should lead to upside for WCS (Cushing) vs WTI (Cushing) this summer and potentially later



Source: Bloomberg

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Exhibit 33: Acronym list

Acronym	Definition
$/bbl	dollars per barrel
2H2023	Second half of 2023
avg	average
b/d	barrels per day
bbl	barrel
bn	billion
boe	barrel of oil equivalent
Btu	British thermal unit
CB	central bank
CPI	consumer price index
D&C	Drilling and completion
DM	developed market
E&P	Exploration and production
ECB	European Central Bank
EM	European market
EM	emerging market
EUAs	European Union Allowances
EUR	Euro
EV	electric vehicle
GoM	Gulf of Mexico
GWh	gigawatt hours
Hz	Horiztonal
IEA	International Energy Agency
JKM	Japan Korea Marker
JPY	Japanese Yen
LNG	liquified natural gas
MA	moving average
mcm	million cubic meters
ME	Middle East
Mfg	manufacturing
MMBtu	million British thermal unit
mn	million
mt	metric ton
MWh	Megwatt hours
NBS	National Bureau of Statistics of China
ngl	natural gas liquids
NWE	North west Europe
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
OPEC+	OPEC countries plus ten additional countries
PMI	purchasing managers index
rhs	righthand side
SPR	Strategic Petroleum Reserve
TMX	Trans Mountain Expasion
TTF	Dutch TTF
TWh	terrawatt hours
WCS	Western Canadian Select
WTI	West Texas Intermediate
YoY	year over year
yr	year

Source: BofA Global Research estimates

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