BofA SECURITIES

Commodity Strategist

Year Ahead 2024: Commodity outlook

Our top five themes

1. Low commodity stocks face off against lower rates, weaker USD
2. Brent may near $90/bbl on deeper cuts as diesel margins drop
3. Gold vigilantes may push prices to $2,400 if Fed cuts in 1Q24
4. Copper may hit $10,500/t, aluminium may rise to 3,000/t
5. On strategy, focus on diversification, carry, backwardation

Easier monetary policy supportive of commodity returns...

The ICE MLCX TR index is down 3.7% YoY but up 0.14% YTD, helped by rising precious metals, energy, and softs. In contrast, base metals and grains returns fell 6.3% and 16% respectively YTD. Our economists see US inflation continuing to slow in 2024, with Fed rate cuts starting in June. Global GDP should expand by 2.8% next year, with very weak US and European growth backdrops. While tight monetary policy and a strong USD held back commodities in 2023, the inverse may support commodities in 2024. Meanwhile, we expect deeper OPEC+ cuts to be unveiled next week, supporting energy prices. Net, upside price potential in metals and firmer energy prices point to modest positive total commodity returns in 2024. Downside risks include recession, lack of OPEC+ cohesion, higher-for-longer interest rates, and faster than expected US shale supply growth.

...with grains, copper, aluminium and gold outperforming

Metals like copper, aluminium, and gold, should perform strongly next year, particularly if rate cuts come sooner. The energy backdrop could improve too. Tighter OPEC+ supplies present upside risk to energy, but non-OPEC+ growth may help cap a large increase in oil prices next year. We project 2023 Brent prices to average $90/bbl, but spot prices may struggle to break $100/bbl as balances require deeper OPEC+ cuts to prevent inventory increases. We are also increasingly constructive transition metals like copper, as rising infrastructure and grid spend in China combines with EV sales growth. We are bullish on other transition precious metals like silver too and think gold has a lot to gain on a Fed pivot, whenever that comes. On a weaker note, US nat gas prices should average $3/MMBtu as supplies continue to grow in a soft demand environment. Also, agricultural commodities should mean-revert as supply responds to the lower prices.

Focus on beta/diversification, carry, backwardation

In commodity beta, pockets of strength in energy and softs in 2H23 offset weak 1H23 returns. Cross-asset returns remain positively correlated and largely driven by rates, yet commodities were more invariant. As such, optimal asset allocation models may point towards an increase in commodity beta inflows. Volatility carry was the stand-out by far in 2023. Next year, carry may perform as curves outside of softs and energy stay in contango, while energy curves are historically the most responsive to sharply slowing macro and rate cuts. If the macro is less dire, strategies like backwardation can perform, while pockets of tightness may deliver relative value returns, like 2023.

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Commodities
Global

View Transcript

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Exhibit 1: Sector and individual commodity views
Sector views for 2024

	Price view	Roll yield view	BofA view relative to benchmark
Energy	Neutral	Positive	Overweight
Brent crude oil	Positive	Positive	Overweight
WTI crude oil	Positive	Positive	Overweight
Natural gas	Negative	Negative	Underweight
Gasoline (RBOB)	Positive	Positive	Neutral
Gasoil	Positive	Positive	Underweight
Livestock	Neutral	Negative	Overweight
Live cattle	Neutral	Negative	Neutral
Lean hogs	Positive	Negative	Overweight
Grains & oilseeds	Neutral	Negative	Neutral
Corn	Positive	Negative	Overweight
Wheat	Positive	Negative	Overweight
Soybeans	Negative	Negative	Underweight
Soybean meal	Negative	Negative	Underweight
Soft commodities	Neutral	Positive	Neutral
Sugar	Neutral	Positive	Neutral
Coffee	Neutral	Neutral	Neutral
Cotton	Positive	Positive	Overweight
Base Metals	Positive	Positive	Overweight
Aluminium	Positive	Positive	Overweight
Copper	Positive	Positive	Overweight
Nickel	Negative	Negative	Underweight
Zinc	Negative	Negative	Underweight
Precious metals	Positive	Negative	Overweight
Gold	Positive	Negative	Overweight
Silver	Positive	Negative	Overweight

Source: BofA Global Research

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Exhibit 2: BofA Commodity Price Forecasts
(period averages)

	units	1Q23F	2Q23F	3Q23F	4Q23F	2023F	1Q24F	2Q24F	3Q24F	4Q24F	2024F
WTI Crude Oil	($/bbl)	76	74	82	82	**78**	86	88	86	84	**86**
Brent Crude Oil	($/bbl)	82	78	86	86	**83**	90	92	90	88	**90**
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	22.6	24.2	23.6	22.5	**23.2**	22.5	23.0	23.5	24.0	**23.3**
Platinum	$/oz	995	1,027	932	950	**976**	1,000	1,000	1,100	1,100	**1050**
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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Exhibit 3: BofA Commodity Research Themes and Outlook

Key takeaways

	Views
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 $90/bbl and $86/bbl, respectively, in 2024. • The global oil balance should stay tight in 2024, as OPEC+ withholds more supply from the market to counteract slowing demand growth • We forecast global demand growth of 2.1mn b/d YoY in 2023 and 1.1mn b/d in 2024. • Non-OPEC supply should grow roughly 2.2mn b/d YoY in 2023 and 1.2mn b/d in 2024. • We project total US crude and NGL supply to rise 1.4mn b/d in 2023 and 590k b/d in 2024. • OPEC crude oil supplies are set to fall 460k b/d in 2023 and 310k b/d in 2024 as OPEC+ actively manages balances
Atlantic Basin petroleum 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.
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
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
Thermal coal	• Seaborne coal prices pulled back on softer balances. Yet, China has come back in earnest, more than doubling thermal coal imports • We remain constructive in 2024 on strong Asian demand and declining Russian supply
Aluminium	• China is almost operating at its 45mt capacity cap and smelters ex-China have closed capacity. • China's smelters remain under pressure on hydro power shortages. At the same time, demand has been strong, so exports will likely remain capped. • We expect rising deficits going forward
Copper	• Demand in China has been patchy, but grid spending has completely offset weakness in housing. Demand may be more balanced in 2024, and should hold up. Copper to rally, if the government pushes leads to broader recovery • Inventories are low, which is supportive, but could also increase volatility • We expect a small surplus for 2024
Lead	• There are no immediate scrap or concentrates shortages, suggesting the market could flip back into surplus
Nickel	• Indonesian supply may prevent shortages near-term, but further out, more material is required • We expect a surplus for 2024, with prices increasingly supported by costs
Zinc	• Zinc may remain an underperformer, but immediate downside more limited, also because costs have shifted higher on inflation • The surpluses could disappear, if more mines close
Gold	• Until the end of the hiking cycle is reached, gold prices will remain capped • Central bank buying has been strong, but not sufficient; a Fed pivot may bring more investors into the market. Gold to rally into 2024 • If rate cuts come before 2Q24, gold could end next year at $2,400/oz
Silver	• The silver market has rebalanced on production discipline and demand from new applications including solar panels • As more spending on solar panels come through, silver should rally. Bottoming out of the global economy in 2024 should also help industrial demand
Platinum/ Palladium	• Palladium is slowly moving into surplus, keeping pressure on prices. More production discipline is necessary. • Any supply cuts may reduce the palladium surpluses, but will likely push platinum into a deficit, so prices might diverge
Grains/ Oilseeds	• We are bearish soybeans due to a potential record South American crop, but weather remains a key risk • Tighter wheat balances driven by dry weather in Australia should provide support for prices this year. • We see downside to soybean crush margins and meal prices on higher processing in the Americas. • We are neutral on sugar with some downside risks to prices if export constraints ease • Corn carryout to rise in 23/23 but price risk skew higher

Source: BofA Global Research estimates

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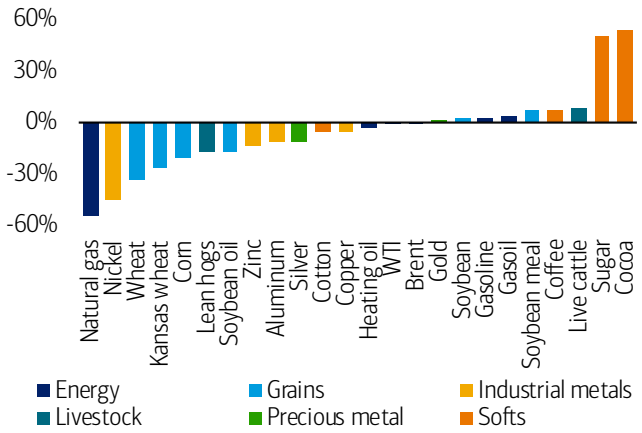
1. Macro overview

Softs, energy, and precious outperformed grains, base metals in '23…

Looking across the commodity complex, we note that total returns for softs such as sugar and cocoa came out on top (Exhibit 4), delivering 22% for investors year-to-date. In stark contrast, grains were by far the worst performing raw material sector this year, with industrial metals not very far behind (Exhibit 5). Despite all the volatility experienced by oil prices during the course of the year, energy will likely end the year higher, as roll returns of 7.5% were weighed by spot returns of -8.2%, but collateral returns were strongly positive year-to-date. Note that total commodity returns measured by the MLCX TR index have neared 0.14% so far this year compared to 19% for the S&P500TR index and -0.8% for the 10y US Treasury total return index.

Exhibit 4: MLCX year-to-date commodity returns

Looking across the commodity complex, we note that returns for softs such as sugar and cocoa came out on top…



Source: Bloomberg

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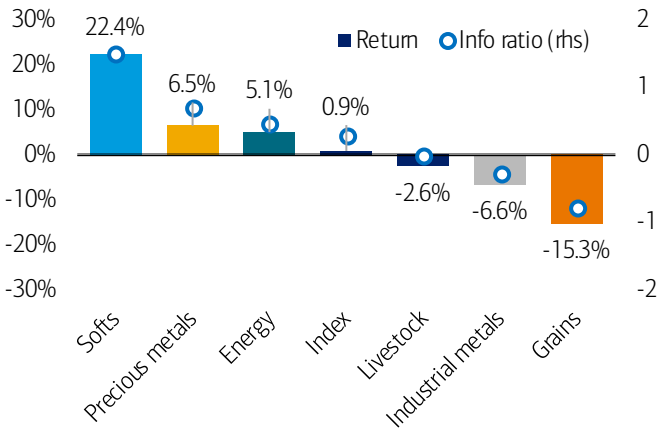
Exhibit 5: MLCX commodity sector index year-to-date returns and information ratios

… while grains were by far the worst performing raw material sector, with industrial metals not far behind



Source: Bloomberg

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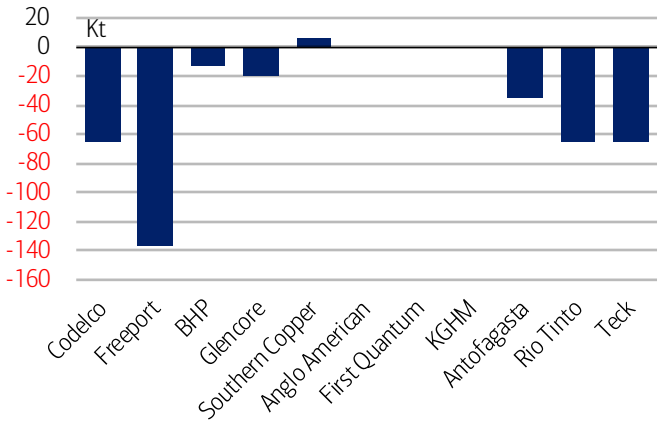
…as slowing economic growth often clashed with supply side issues

The returns delivered by commodities have been rather diverse and attained against a slowing macroeconomic backdrop in which the China post-Covid reopening failed to live up to its hype. Supply in a number of key commodities such as copper failed to grow in line with expectations ultimately lending support to the red metal as the real estate crisis in China deepened (Exhibit 6), while energy-linked agricultural commodities such as corn and sugar diverged, leaving ethanol prices in a limbo (Exhibit 7) as biofuel supplies continued to grow.

Exhibit 6: Change in 2023 production guidance
Supply in a number of key commodities such as copper failed to grow in line with expectations...



Note: Freeport is sales guidance, BHP figures consolidate Escondida and is per fiscal year
Source: company reports, BofA Global Research

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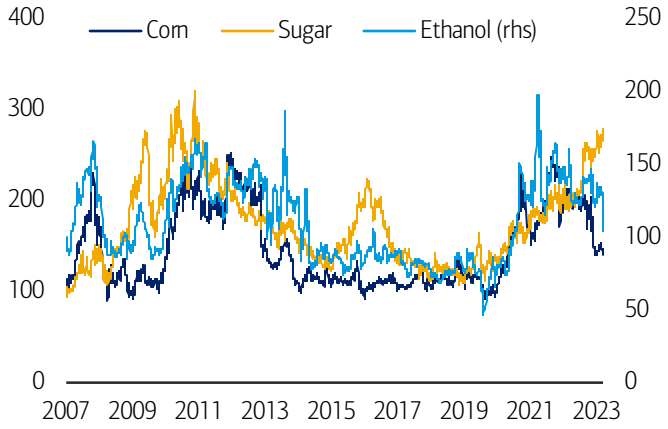
Exhibit 7: Corn, sugar, and ethanol front-month futures/swap prices indexed to Sep-2007
... while energy-linked agricultural commodities such as corn and sugar diverged, leaving ethanol in limbo



Source: Bloomberg

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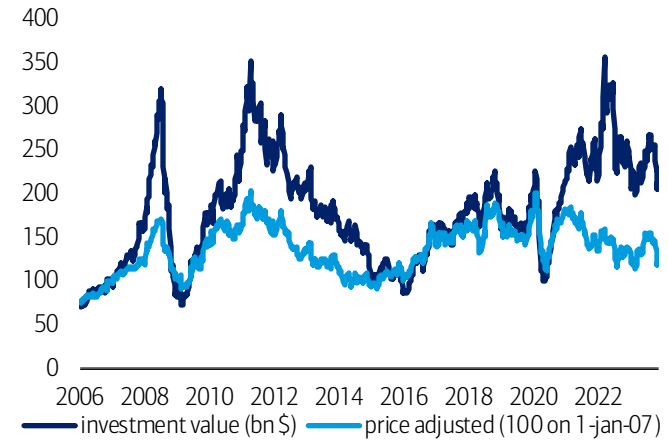
Commodity investors have continued to pare back their positions...

As a result of worsening macro headwinds such as higher interest rates and rising recession risks in the US and China, commodity investors have continued to reduce their positions in the asset class (Exhibit 281). We estimate investor assets are now at around $208bn compared to $221bn at the start of the year, with an average decrease in the value of positions of 6.5%. Similarly, our analysis of systematic flows also points to a sharp reversal in commodity longs in the past month (Exhibit 9) after a blip in early September driven by the extension of the Saudi cuts into 2024.

Exhibit 8: Commodity index assets under management
As a result of worsening macro headwinds, commodity investors have continued to reduce their positions...



Source: BofA Global Research, CFTC

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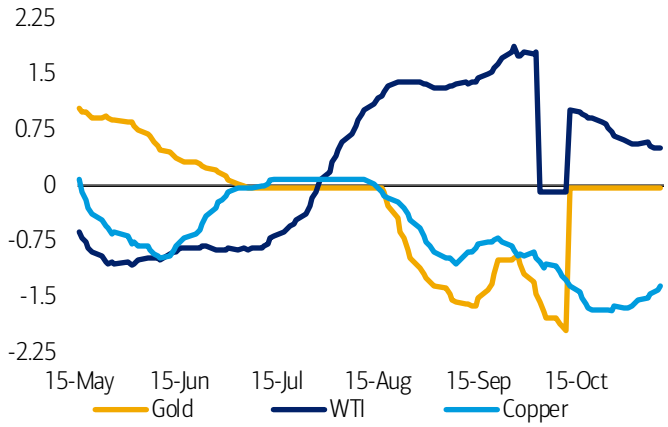
Exhibit 9: BofA Trend Following (CTA) Oil, Gold, and Copper (HG) Position
... while our analysis of systematic flows also points to a sharp reversal in commodity longs in the past month



Source: BofA Global Research. Data as of 10-Nov-2023

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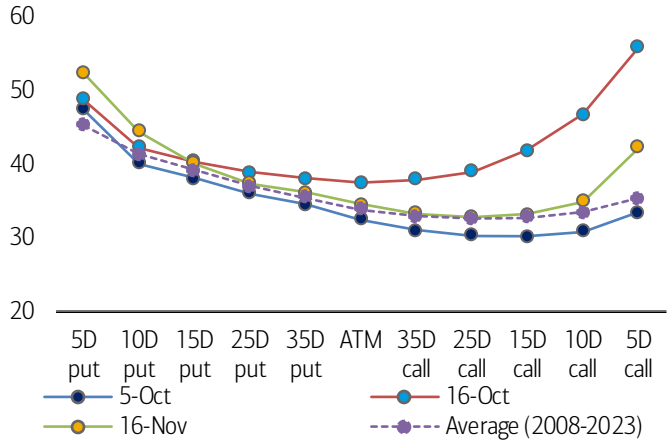
...as Middle East tensions have not led to supply dislocations so far

While heightened tensions in the Middle East initially triggered a big dislocation in oil options markets (Exhibit 10) that led to a pronounced call skew over a number of weeks, oil supplies have continued to expand in November. Russian cargoes specifically have moved higher (Exhibit 11) and seaborne exports averaged 3.5mn b/d in the past week, the highest levels since July. The Russian export surge is not surprising from a financial point of view, as Russia needs all the money it can get to keep funding its military efforts, but begs the question of how much policy coordination remains within the OPEC+ group.

Exhibit 10: Brent crude 3-month option skew
While heightened tensions in the Middle East initially triggered a big dislocation in oil options markets...



Source: Bloomberg

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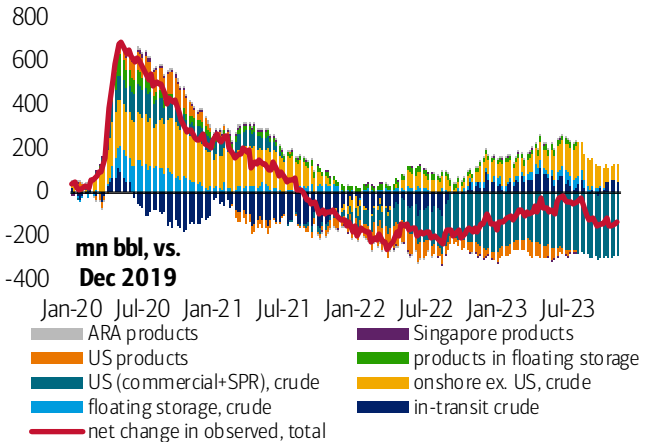
Exhibit 11: Observed change in petroleum inventories
... oil supplies have continued to expand in recent weeks, with Russian cargoes specifically moving higher



Source: Kayrros, Bloomberg, BofA Global Research

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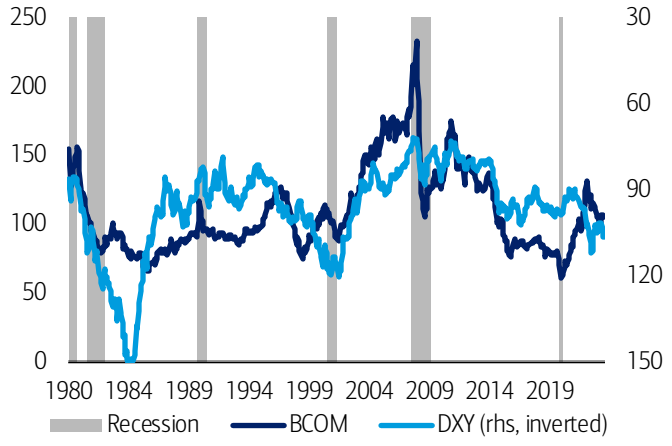
Raw materials have become less connected to currency moves...

While incremental supplies in Russia and also in the US are likely behind some of the latest declines in prices, other macro forces are at work. It is important to remember that the historical relationship between the DXY and commodity investor returns seems rather broken (Exhibit 12), even though commodity prices in local currency such as EUR, GBP, or JPY have hovered at very high levels (Exhibit 13). Perhaps the weaker growth projected by consensus forecasters, as well as by BofA, for developed economies into 2024, may once again change this relationship.

Exhibit 12: Bloomberg commodities index (BCOM) and dollar index (DXY)
Meanwhile, the historical relationship between the DXY and commodity investor returns seems rather broken...



Source: Bloomberg

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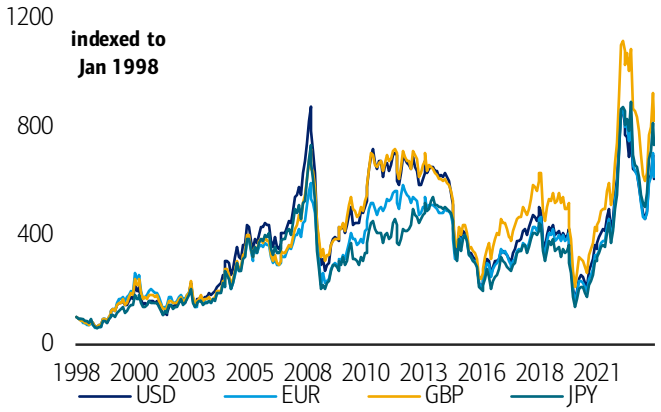
Exhibit 13: Front month gasoil futures price in local currency indexed to January 1998
... even though commodity prices in local currency such as EUR, GBP, or JPY have hovered at very high levels



Source: Bloomberg, BofA Global Research

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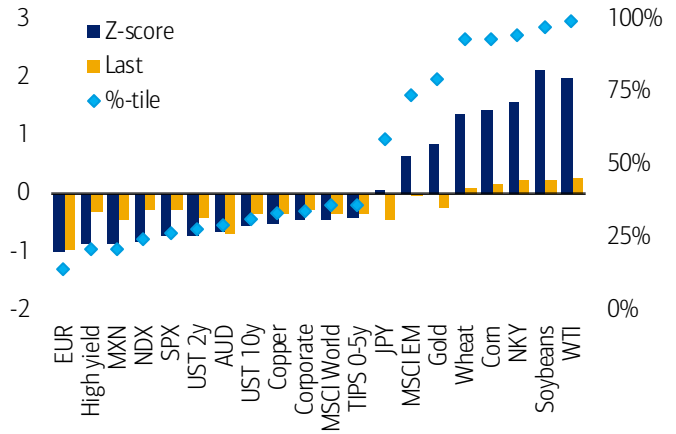
....and at times oil dollar correlations have actually turned positive...

Interestingly, commodity correlations to the dollar have surged in recent months to become some of the most positive in history (Exhibit 14) with commodities like oil and grains showing some of their most positive linkages to the US currency in recent memory. Note that this high positive commodity/dollar correlation is a clear break from the historically highly negative oil-dollar correlations witnessed in the 1990s and 2000s (Exhibit 15). Will the positive commodity/DXY link last into next year? If lower US rates

eventually trigger a weaker USD in 2024 as our FX team expects, we believe that the correlation could again flip as commodity demand improves.

Exhibit 14: Rolling 63-day cross-asset correlations to DXY, percentile, and z-score
In fact, commodity correlations to the dollar have surged in recent months to some of the most positive in history...



Source: BofA Global Research estimates, Bloomberg

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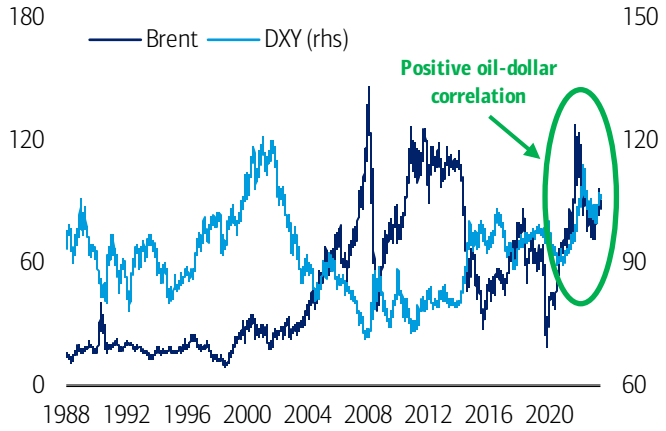
Exhibit 15: Brent crude oil front month futures price and broad dollar index (DXY)
... which suggest that the linkage between dollar pricing and commodity demand could not be as penalizing as before



Source: Bloomberg

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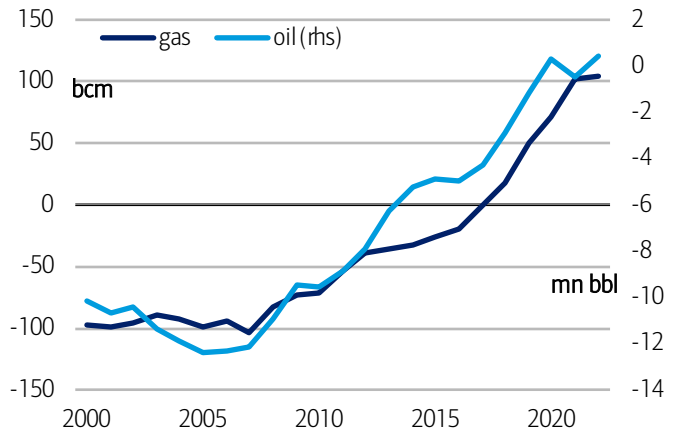
...supported by America's growing dominance of commodity flows

Truth be told, the breakdown in USD/commodity correlations has had a lot more to do with US export dynamics that demand itself, even if expansive global GDP periods tend to coincide with a weaker US currency. While the US was the world's largest energy importer in 2008, it is now a net exporter of gas, chemicals and petroleum products (Exhibit 16). So higher commodity prices tend to positively impact the US trade balance. Similarly, America's agricultural balances have continued to improve, allowing America to dominate this space too (Exhibit 17) and setting the stage for USD strength when commodity prices are high. Nonetheless, a weaker USD in 2024 should support nominal GDP growth in USD and thus commodity prices, in our view.

Exhibit 16: Net US exports
While the US was the world's largest energy importer in 2008, it is now a net exporter of gas, chemicals and petroleum products



Source: Energy Institute

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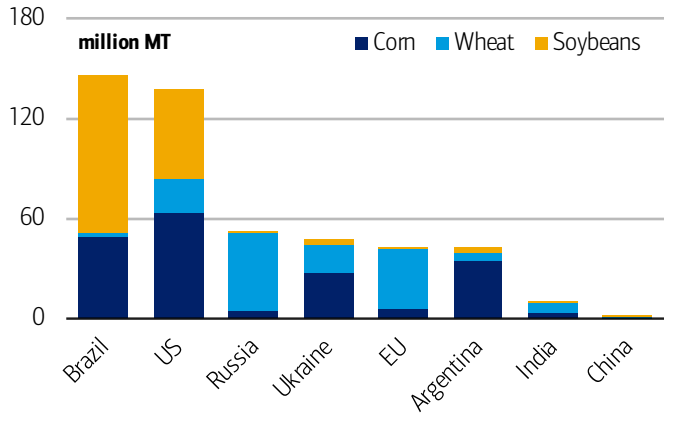
Exhibit 17: Global corn, wheat, and soybean exports as a percentage of global exports
Similarly, America's agricultural balances have continued to improve, allowing America to dominate this space too



Source: USDA

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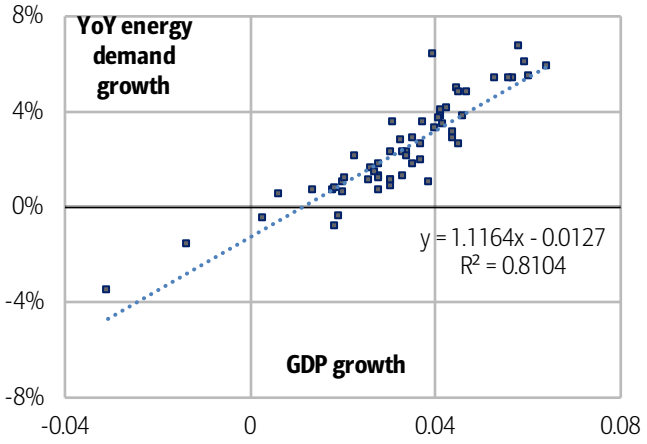
Commodity returns are increasingly linked to GDP growth and rates

Another key factor to consider when looking at commodities into 2024 is the pace of expansion of the global economy. World GDP expanded by 3.5% last year and by 3%

this year. Most forecasters, including BofA, point to a decelerating growth environment into 2024 as a result of the very restrictive monetary policy backdrop. Energy demand growth is usually very closely linked to GDP, as productivity growth highly depends on it (Exhibit 18). Moreover, oil price changes are also highly connected to GDP changes, but price moves are often highly amplified (Exhibit 19).

Exhibit 18: World GDP and energy demand growth (1966-2022)
Energy demand growth is usually very closely linked to GDP, as productivity growth highly depends on it



Source: BP, Bloomberg

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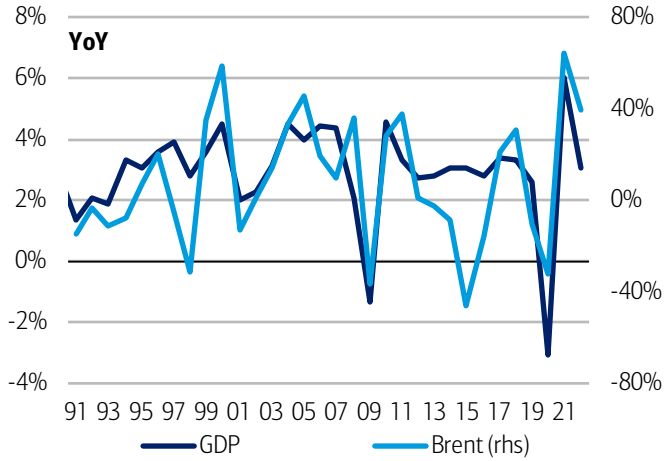
Exhibit 19: Global GDP growth and Brent crude oil returns
Moreover, oil price changes are also highly connected to GDP changes, but price moves are often amplified



Source: World Bank, Bloomberg

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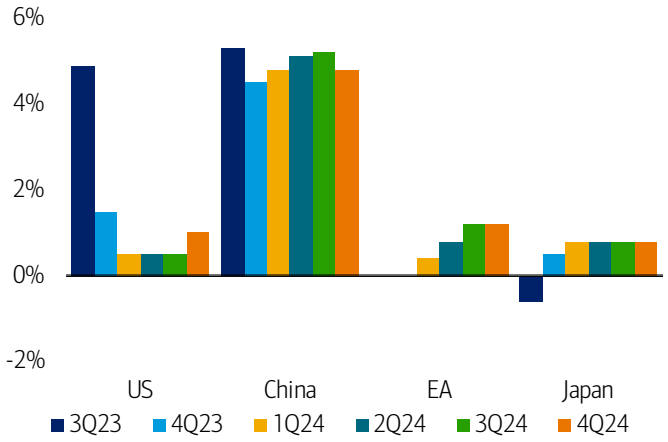
The world is set to slow in 2024, but outcomes range by country and scenario

In addition to slower global growth in 2024, our global economics team forecasts divergences in growth paths across major economies. While the US is set to slow from its blistering pace through 3Q24 before rebounding in 4Q24, China, Europe, and Japan are each forecast for consecutively rising growth throughout 2024, albeit from sluggish paces (Exhibit 20). This has important implications because if demand is slowing in some regions while picking up in others, net effects on commodity demand and growth could potentially wash out.

To further complicate matters, our economics teams have also highlighted potential alternative scenarios including an overheating economy and persistent inflation that leads to a melt up in growth and rates before crashing in late 2024/early 2025, an oil price shock stemming from conflict in the Middle East, a bearish China shock that underwhelms on stimulus, and bullish growth and immaculate disinflation. Each of these scenarios would likely be bullish crude oil, with a crash in the overheating scenario late in 2024, while copper would underperform under each outcome bar the bullish case.

Exhibit 20: BofA global economics quarterly real GDP forecasts
Our global economics team looks for a slowdown in the US through 2024 which diverges from rebounding China, Europe, and Japan growth



Source: BofA Global Research

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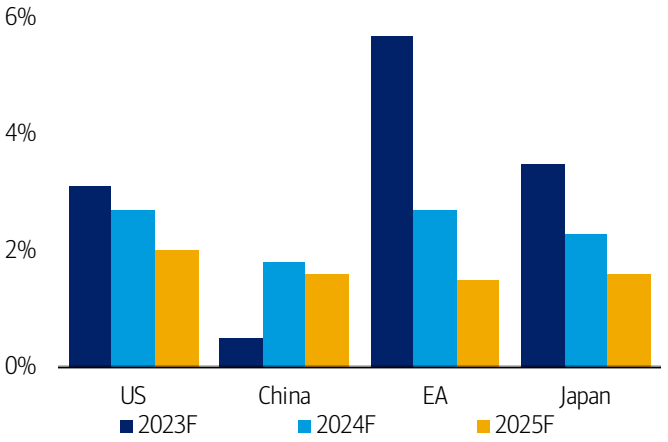
Exhibit 21: BofA global economics annual headline inflation forecasts
Global disinflation is forecast to continue making progress, reaching target by 2025



Source: BofA Global Research

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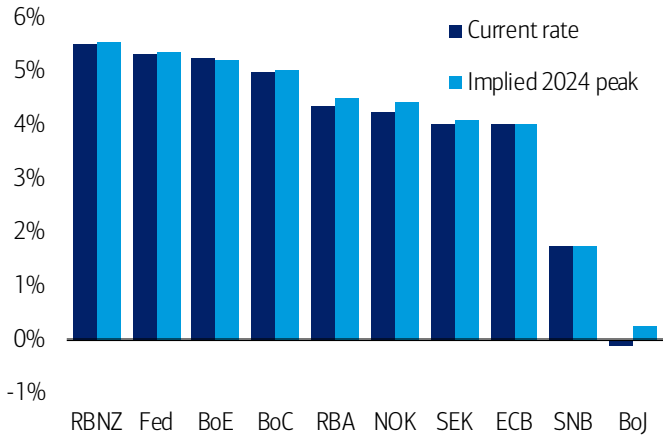
Thus, where do rates settle & rate cuts start is key for the asset class

If global GDP slows down materially beyond consensus expectations, demand for commodities will also slow down and prices should, other things being equal, fall to reflect the weaker backdrop. Lower commodity prices and lower growth would in turn allow for monetary policy easing at some point in the future. Thus, the question of where interest rates settle and whether the impact on growth is moderate or more dramatic is key for commodities, although markets assume US and European rates are at or close to peak (Exhibit 22). From here on, US interest rate markets price in declines of about 100bps over the course of 2024 (Exhibit 23).

Exhibit 22: G10 central bank policy rates and OIS implied peak through 2024
Where interest rates settle is a key question for commodities, although markets assume we are at or close to peak



Source: Bloomberg, BofA Global Research

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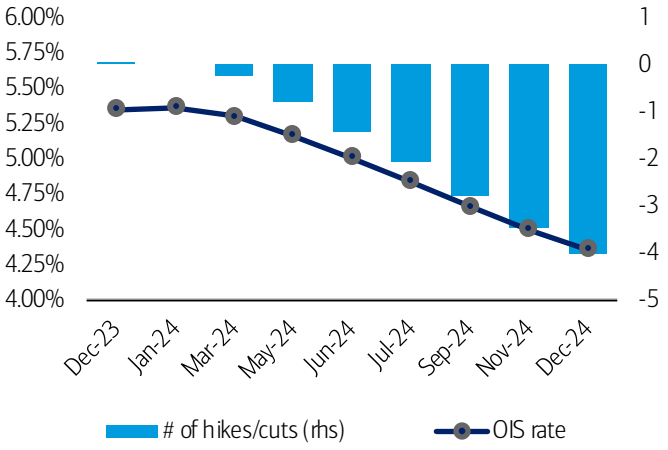
Exhibit 23: US OIS implied rates
From here on, US interest rate markets price in declines of about 100 bps over the course of 2024



Source: Bloomberg, BofA Global Research

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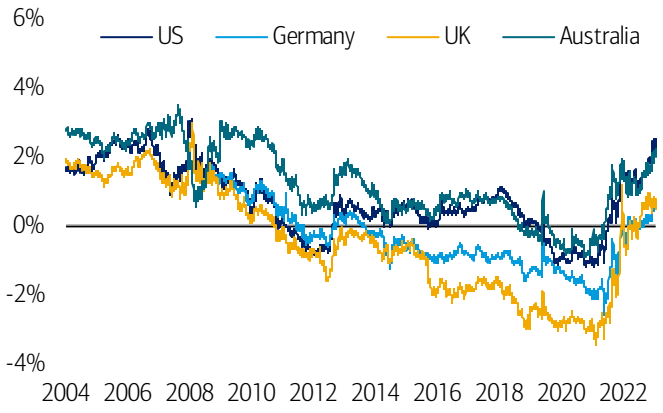
While a run up in rates could slow growth, hurting commodity returns...

A run up in interest rates, whether nominal or real, should eventually impact economic activity negatively. The crucial question of course is how negative the hit will be. Real interest rates have increased very markedly during the course of this year as demand for money outpaced supply (Exhibit 24). If rates have done their work, oil demand should ease and prices should fall. However, there is also an open debate as to what the new neutral interest rate will be in a post-Covid world (Exhibit 25). In turn, a higher neutral

implies that the current level of policy rates may or may not necessarily be consistent with lower economic activity and thus lower oil demand growth.

Exhibit 24: 10 year real rates
Real rates have increased very markedly during the course of this year as demand for money outpaced supply...



Source: BofA Global Research, Bloomberg

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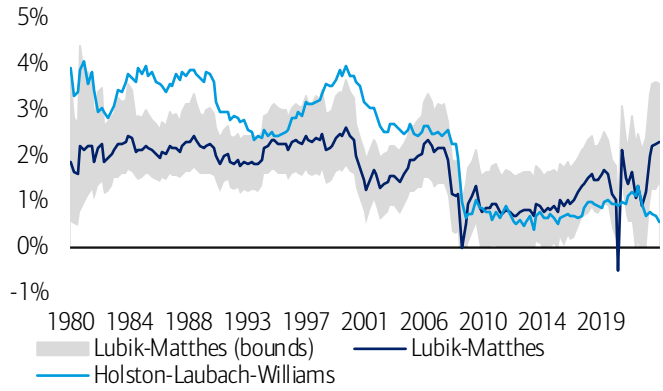
Exhibit 25: Holston-Laubach-Williams and Lubik-Matthes estimates of US neutral interest rate
... and there is an open debate as to what the new neutral interest rate will be in a post-Covid world



Source: Federal Reserve Bank of New York, Federal Reserve Bank of Richmond

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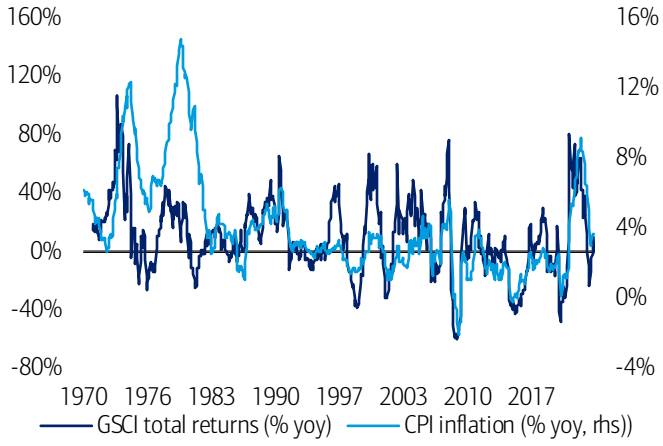
...and inflation still has to ease meaningfully in line with expectations...

In any case, the one relationship that still remains an anchor of commodities as an asset class is inflation. Commodity prices have maintained an exceptionally strong relationship with inflation over many decades as a result of two drivers. First, food and energy are an important part of the US and global inflation baskets, and an increase in commodity prices impacts headline inflation directly and through lagged effects as raw materials seep through other segments of the economy. Second, energy is the most volatile component of inflation because prices change every second of the day, having an outsized influence in expectation settings (Exhibit 26). As of now, inflation expectations embedded into fixed income markets point to a pronounced deceleration in price rises ahead (Exhibit 27).

Exhibit 26: Annual GSCI total returns and US CPI inflation
Commodity prices have maintained an exceptionally strong relationship with inflation over many decades



Source: Bloomberg

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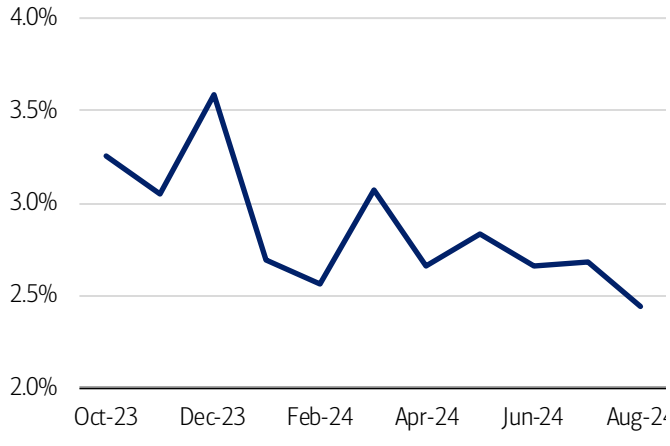
Exhibit 27: US CPI year-on-year swaps implied inflation
Now inflation expectations embedded into fixed income markets point to a pronounced deceleration in price rises ahead



Source: Bloomberg

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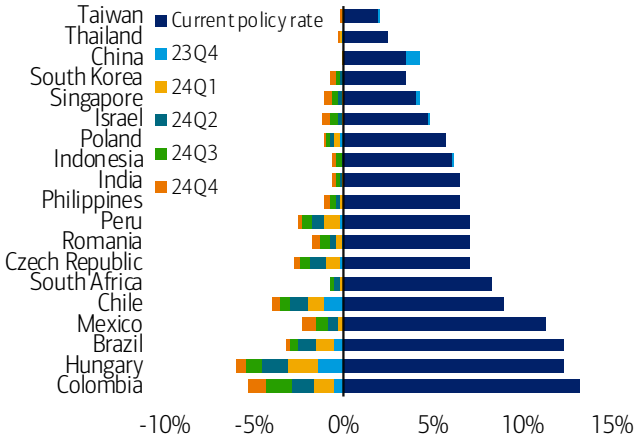
...EM central banks are cutting rates, a positive for the asset class

Because commodity curves are mostly in backwardation (i.e. forward prices are below spot), we believe inflation expectations tend to underestimate the risks of a resurgence

in commodity prices on a forward basis. Looking at Bloomberg, we note that consensus projections point to a continued reduction in rates across EMs on the basis of falling inflation expectations and increased policy bandwidth to support economic activity (Exhibit 28). Meanwhile, we expect developed markets to follow suit over the course of 2024, potentially leading to a pivot in macro conditions (Exhibit 29) and an improvement in commodity demand if easing is not forced by significant growth contractions.

Exhibit 28: Bloomberg median expectation of emerging market monetary policy rates

Looking at Bloomberg consensus, we note that projections point to a continued reduction in rates across EMs



Source: BofA Global Research, Bloomberg

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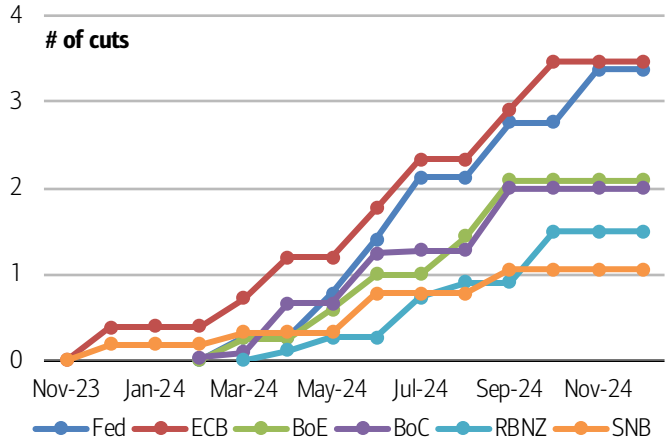
Exhibit 29: Number of swaps implied cuts from max implied rate

Meanwhile, we expect developed markets to follow suit over the course of 2024, potentially changing macro conditions



Source: BofA Global Research, Bloomberg

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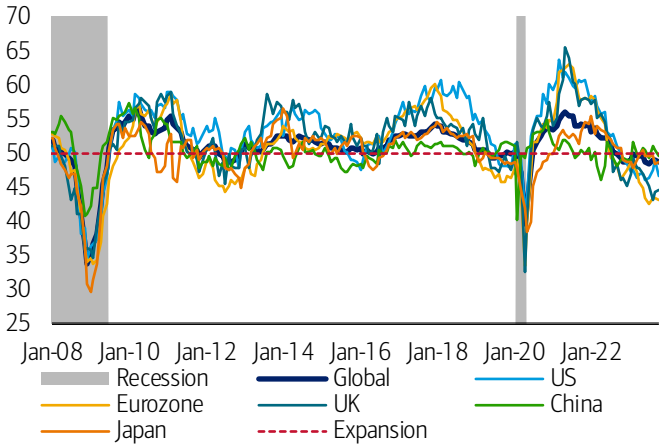
Also, commodity returns have become less linked to PMI moves

While recession risks have featured prominently in the narrative of financial markets this year, the departure point matters. Looking at PMIs, we note the marked downward trend in recent months, a major headwind to commodities this year, and point to the fact that eventually manufacturing expectations tend to improve as reduced industrial activity allows for a reduction in excess inventories of intermediate and finished good (Exhibit 30). Even then, the relationship between commodity returns and PMIs seems to have changed considerably (Exhibit 31) as outside of sustained grid spending supporting copper demand in China, our European economists highlight that sub-50 manufacturing PMIs may not actually reflect as dire industrial activity and can be consistent with low or zero, not contracting growth (see Europe Economic Weekly: Message understood (we think).

Exhibit 30: Global manufacturing purchasing manager indices (PMI)
Looking at PMIs, we note that marked downward trend in recent months, a major headwind to commodities this year



Source: ISM, Markit, Haver

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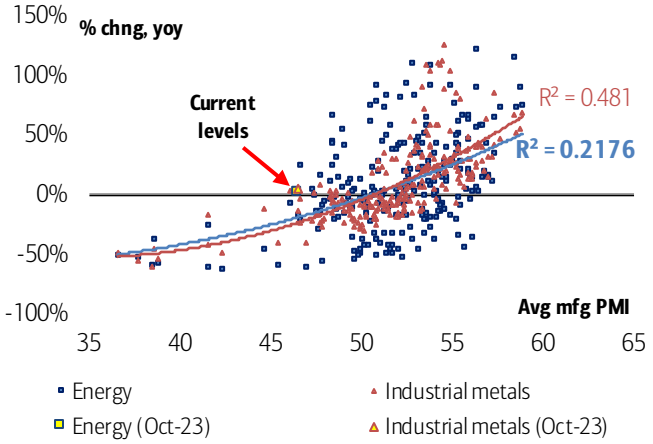
Exhibit 31: Average manufacturing PMIs (US, China, Eurozone) and annual commodity sector index returns
Even then, the relationship between commodity returns and PMIs seems to have changed considerably



Source: ISM, Markit, Bloomberg

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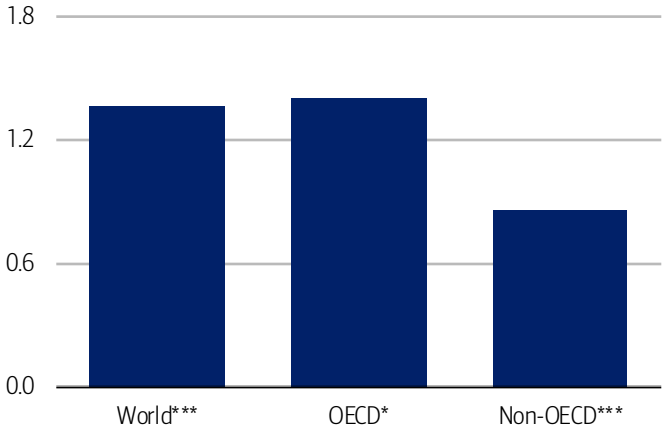
Still, the sensitivity of oil demand to GDP growth is higher for DMs...

So what does a tight money policy and declining PMI industrial backdrop mean for the energy complex? Oil demand is much more sensitive to changes in GDP in developed economies than in emerging economies (Exhibit 32), so the composition of growth matters. We have long argued that global oil demand will likely expand by 1.1mn b/d in 2024 following a 2mn b/d expansion this year, with OECD oil demand growth moving from a slight expansion of 120k b/d to a modest contraction of 240k b/d. Put differently, our commodity demand forecasts already assume that the projected deceleration in DM economic activity over the coming quarters could hurt oil demand growth (Exhibit 33). Yet we still have to pencil in any potential positives from lower rates.

Exhibit 32: Elasticity of oil demand to GDP growth (% year-on-year controlling for Brent crude returns)
Oil demand is much more sensitive to changes in GDP in developed economies than in emerging economies...



Source: BP, IMF, BofA Global Research estimates

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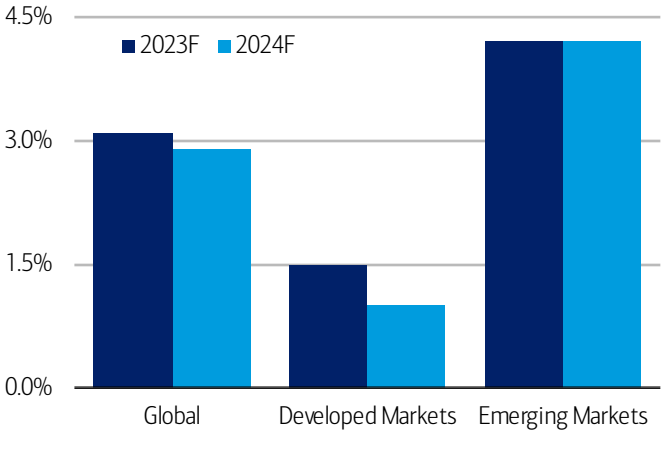
Exhibit 33: BofA global economics GDP forecasts
... suggesting the projected deceleration in DM economic activity over the coming quarters could hurt oil demand growth



Source: BofA Global Research

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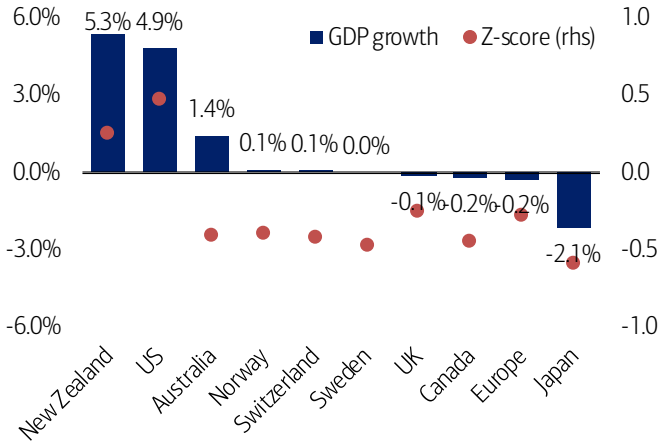
...and fiscal issues could come back to haunt fixed income markets...

Although economic growth has defied expectations and remained resilient in a number of large economies including the US but has recently started to turn (Exhibit 34), government budget deficits remain rather imbalanced and growing debt supply could lead to sustainability issues (Exhibit 35). The US government budget deficit has already

doubled in size this year against much more moderate expectations, and the higher rates have not helped balance public books. The deficit has been further amplified by a big 7% boost in tax band rates in 2023 (and again another 5%+ coming in 2024) that has reduced income tax revenues even as the economy expanded.

Exhibit 34: Latest G10 annualized quarterly GDP growth
Although economic growth has remained resilient in a number of large economies including the US...



Source: Haver

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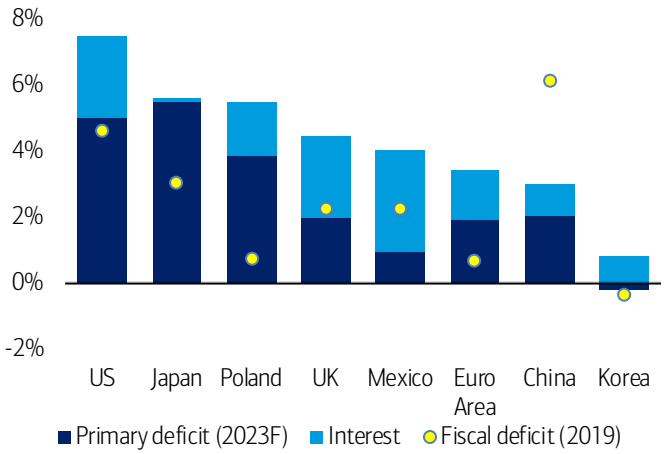
Exhibit 35: Global primary and fiscal deficits as percentage of GDP
... government budget deficits remain rather imbalanced and growing debt supply could lead to sustainability issues



Source: BofA Global Research, IMF, CBO

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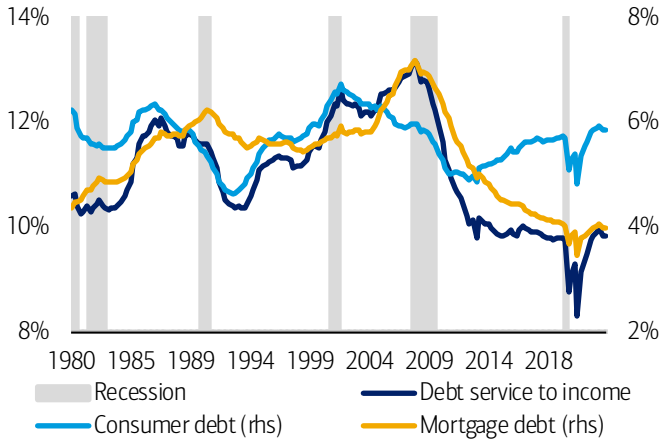
...although the US consumer remains resilient as debt levels are low

The lack of fiscal discipline in the US as well as some other major economies has continued to support growth, but at an important cost. While US federal government debt levels are high and rising into $34tn, the level of US consumer debt as a share of disposable income remains quite low as does debt service (Exhibit 36). Of course, many consumers refinanced their debts during the pandemic and much of the interest rate risk sits in the hands of government. Meanwhile, commercial and industrial bank lending conditions have tightened during the past year, but consumer loans continue to grow (Exhibit 37) owing to a cleaner balance sheet.

Exhibit 36: US debt service to disposable income
While government debt levels are high, debt service for consumers as a share of disposable income remains quite low



Source: Federal Reserve

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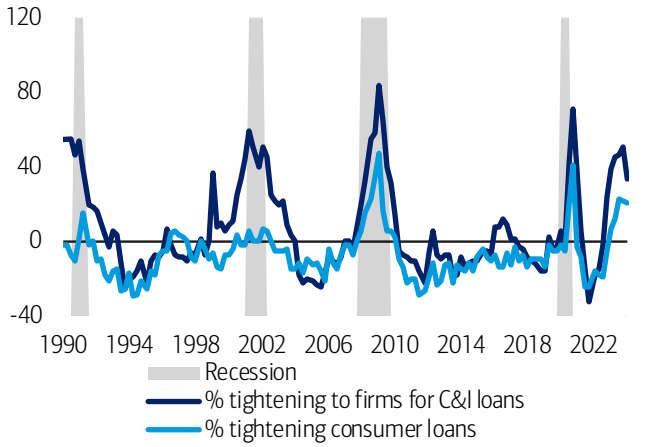
Exhibit 37: Senior Loan Officer Opinion Survey (SLOOS) percentage respondents reporting tighter conditions for industrial and consumer loans
Commercial and industrial bank lending conditions have tightened during the past year, but consumers loans continue to grow



Source: Federal Reserve

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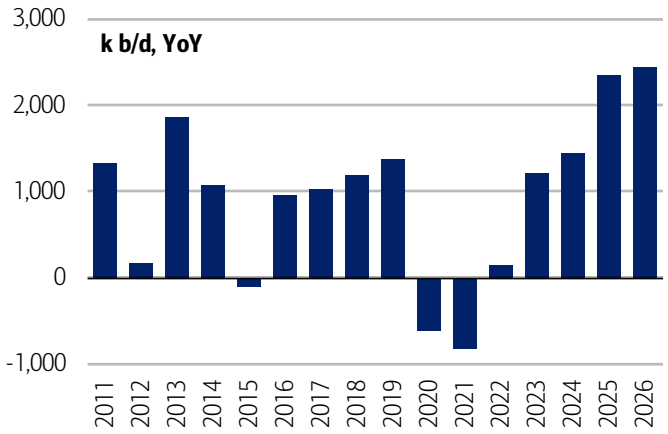
From aggs to energy to metals, micro supply issues have dominated...

To sum up, the macro situation remains in flux with easy fiscal policy and tight monetary allowing for relatively robust consumer activity and economic growth in the US and elsewhere. Meanwhile, from agriculture to energy to metals, the commodity complex has faced a number of micro supply issues that have triggered price rallies throughout this year and will likely continue to do so in 2024. For example, the contraction in refining capacity during the pandemic, coupled with the Ukraine war, triggered exceptional fuel margins (Exhibit 38), while a drought in Europe and Florida respectively lifted the prices of olive oil and orange juice around the world (Exhibit 39).

Exhibit 38: Global refining capacity growth
The contraction in refining capacity during the pandemic, coupled with the Ukraine war, triggered exceptional fuel margins



Source: Platts, BofA Global Research estimates

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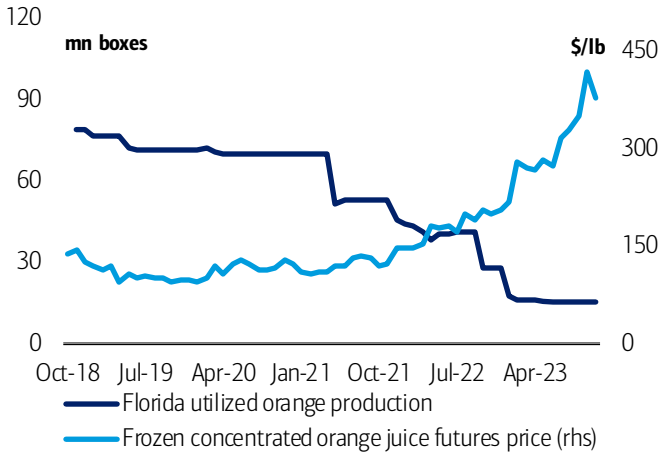
Exhibit 39: Florida utilized orange production and orange juice front month futures price
A drought in Europe and Florida respectively lifted the prices of olive oil and orange juice around the world



Source: Bloomberg, USDA

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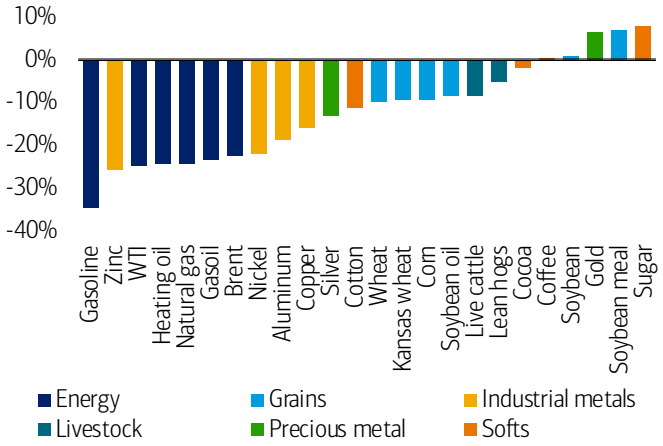
...but a global recession could push all commodity prices lower in '24

The upward moves in commodity markets triggered by micro supply shocks in an environment of relatively steady demand growth have been quite pronounced compared to history and have resulted in significant dispersion in commodity returns across the asset class, a development that partly resembles the narrow breadth in the US equity market. So will commodity markets become highly correlated again? For that to happen, global economic activity needs to move in tandem. Historically, global recessions have had a negative impact on commodity prices across the board (Exhibit 40) with cross commodity correlations spiking whenever macro economic activity collapsed around the world (Exhibit 41). But periods of exceptional economic strength have also allowed for higher cross commodity correlations.

Exhibit 40: Average front month commodity futures return across US recessions

Historically, global recessions have had a negative impact on commodity prices across the board...



Source: BofA Global Research, Bloomberg. Data from Jan-1980 and subject to data availability by commodity.

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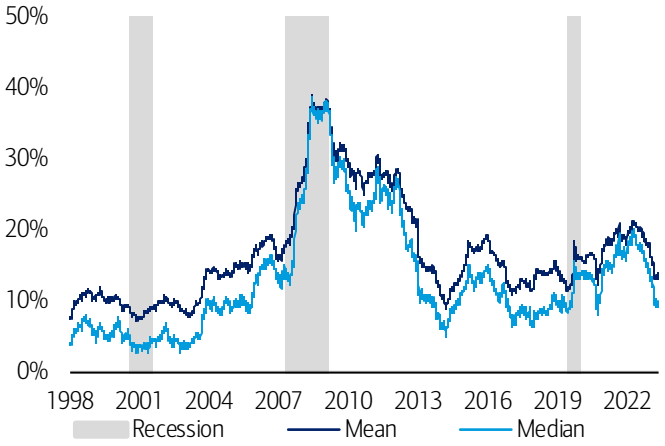
Exhibit 41: Average rolling 1-year cross-correlations across BCOM commodities

... with cross-commodity correlations spiking whenever macro economic activity collapsed around the world



Source: BofA Global Research estimates

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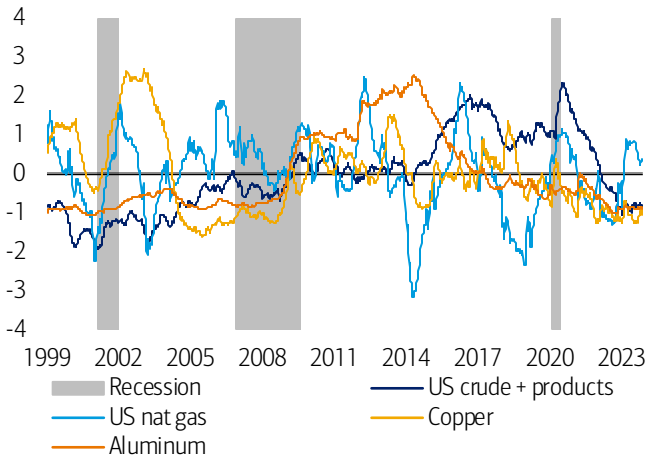
Even then, inventories for raw materials and finished goods are low...

Looking back, 2023 seems like a transition year where each commodity market behaved independently after an exceptionally volatile 2022 driven by a post-Covid demand recovery and a war in Ukraine. Still, it will not take much to trigger an increase in commodity correlations, either up or down. Looking at raw materials, we note that inventories are relatively low for many commodity markets (Exhibit 42) and we also point to relatively low stocks of both intermediate and finished goods, a set up for a restocking cycle if demand holds up or recovers (Exhibit 43). Thus, 2024 could well be a year where easier policy triggers a joint run up in commodity prices, or a year where the lagged effects of monetary tightening trigger a joint meltdown across all sectors.

Exhibit 42: Z-score of commodity inventories

Looking at raw materials, we note that inventories are relatively low for many commodity markets...



Source: DOE, LME, CME, SHFE

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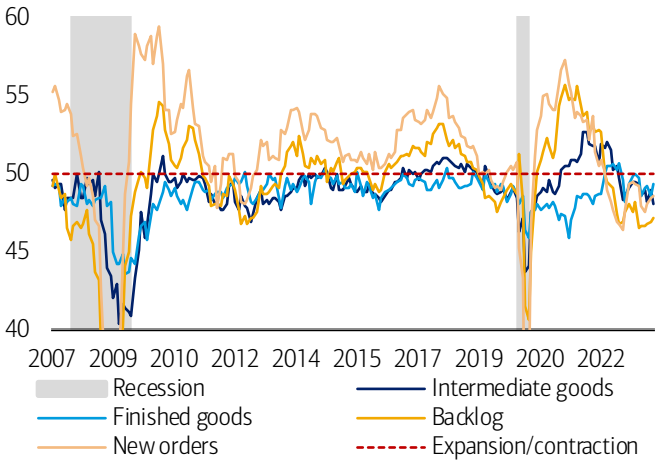
Exhibit 43: Markit global manufacturing purchasing manager indices (PMIs)

... and we also point to relatively low stocks of both intermediate and finished goods, a set up for a restocking cycle if demand picks back up



Source: Markit

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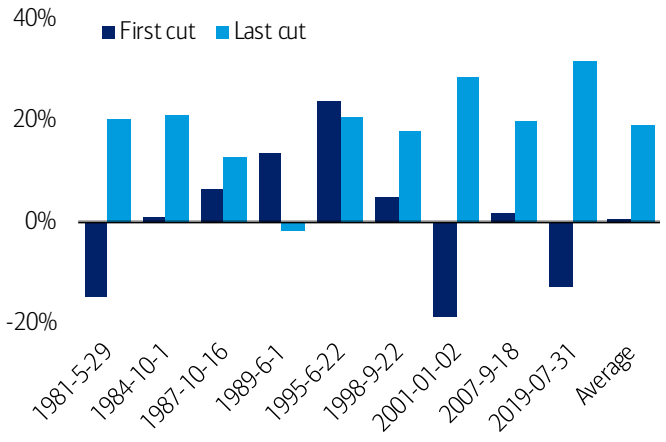
...suggesting a monetary policy shift may boost commodity returns

To provide some context to this observation, we note that interest rate cutting cycles have historically fueled commodity prices by an average of 19% after the last cut (Exhibit 44), with energy and industrial metals sectors tending to outperform the more

micro and weather-driven grains markets. It is key to note that historically, the start and duration of the cutting cycle has commonly coincided with macro weakness and risk-off, thus while the start of the policy easing can be a positive development for oil this time around, it is highly contingent on the context. The most consistent reflations have occurred directly after the last cut once macro conditions have stabilized. Yet we note that commodity price increases have been most significant whenever stocks (and positioning) were low to begin with (Exhibit 45). Given where commodity inventories stand today, we believe a monetary policy shift, already underway in emerging markets, could be a signal to increase allocations to energy and commodities as an asset class, so long as progress on inflation rather than collapsing growth is the driver.

Exhibit 44: BCOM returns in year after first and last cut of Fed cutting cycles

Historically, interest rate cutting cycles have fueled commodity prices by an average of 19%, but only after the last cut...



Source: BofA Global Research

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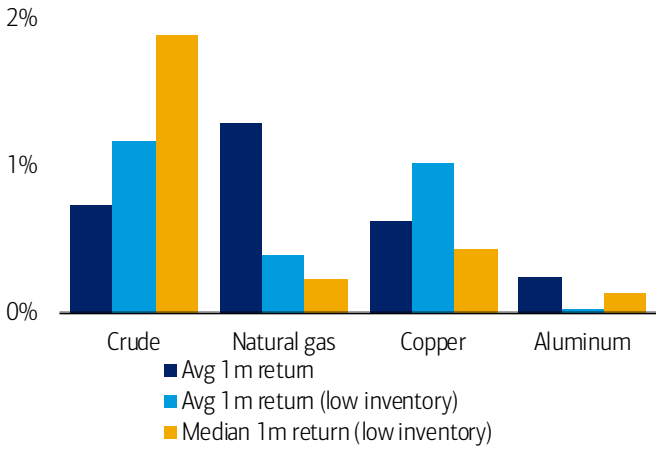
Exhibit 45: Average 1-month commodity price returns conditional on rolling 2-year z-score of inventories below -1

... but we note that commodity price increases have been most significant whenever stocks (and positioning) were low to begin with



Source: BofA Global Research, Bloomberg, DOE, LME, CME, SHFE

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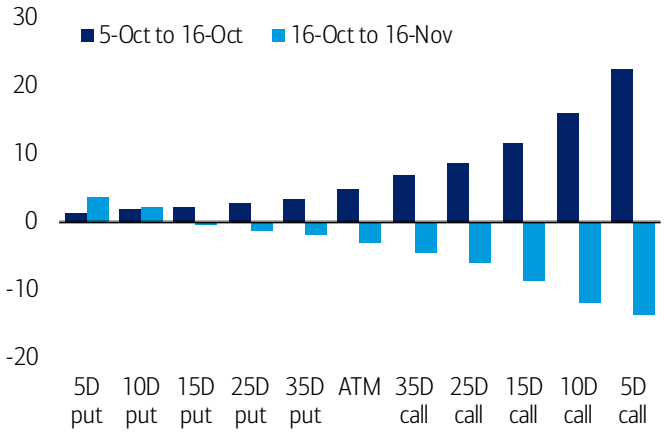
2. Energy outlook

2.1 Crude oil

Israel-Palestine conflict creates upside risks to oil…

Oil prices fell from $96/bbl in late September to $84/bbl in early October after the OPEC+ meeting did not provide any additional information on production cuts heading into 1Q24. In October oil prices moved up a few dollars in just two weeks on the back of risks created by the Israel-Palestine conflict, but the volatility smile has quickly moved into a smirk as option traders have moved to price the risks of an escalating conflict into oil derivatives (Exhibit 46). Importantly, Brent prices did not recover as a result of any specific energy supply disruptions, but rather due to fears of dislocations because Middle East crude oil exports have been averaging ~16.5mn b/d in recent months and represent 17% of the world's oil volumes (Exhibit 47).

Exhibit 46: Brent crude Dec-23 option skew
Oil's vol skew shifted higher and bullish initially following the confrontation but premiums have since deflated



Source: Bloomberg

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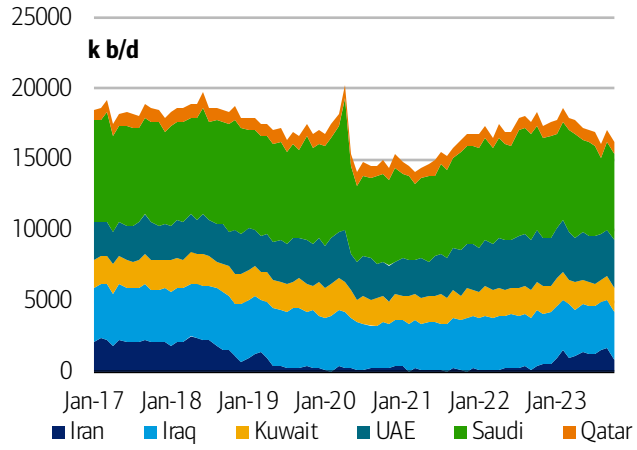
Exhibit 47: Middle East crude oil exports
Middle East crude oil exports have been averaging ~16.5mn b/d in recent months and represent about 17% of world supplies



Source: Bloomberg

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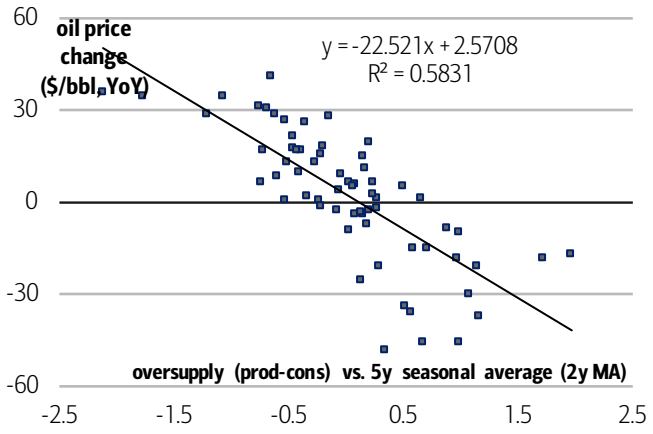
…if regional military or economic tensions escalate…

Given the scale of export volumes leaving the Middle East every day and the continued declines in global oil inventory levels, it should come as no surprise that oil prices have reversed their prior drop on Middle East tensions. Historically, an unexpected shift of 1mn b/d in global crude oil balances has resulted in a $20-$25/bbl move in prices (Exhibit 48). A regional military escalation could result in production losses across different fronts, as there are multiple energy chokepoints across the Middle East, including Hormuz, Suez, Abqaiq, or the Kirkuk-Ceyhan pipeline (Exhibit 100), to name a few.

Exhibit 48: Brent crude oil price changes vs. global oil oversupply
Historically, an unexpected shift of 1mn b/d in global crude oil balances has resulted in a $20-$25/bbl move in prices



Source: Bloomberg, IEA, BofA Global Research estimates

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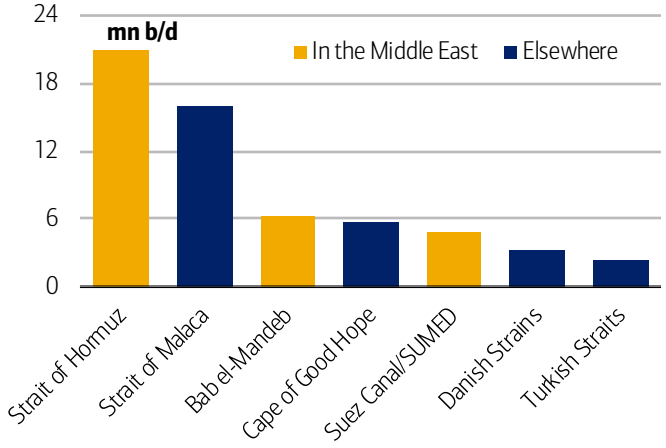
Exhibit 49: EIA chokepoints
There are multiple energy chokepoints across the Middle East, including Hormuz, Suez, Abqaiq, or the Ceyhan pipeline plus plenty of countries at risk



Source: EIA (estimates as of 2019), BofA Global Research

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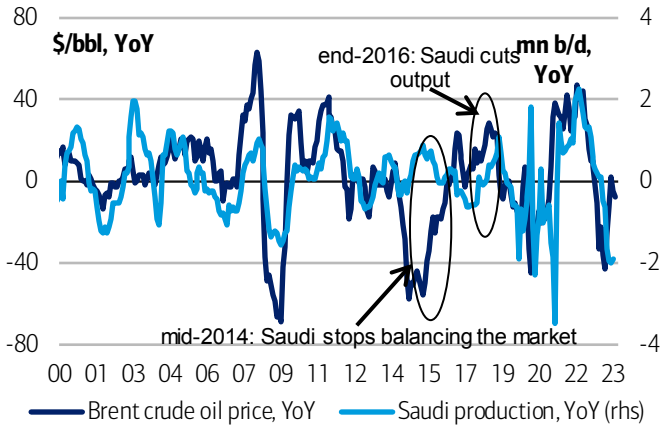
...while downside is floored by OPEC+, China, & SPR

Importantly, as the most recent interaction between Brent crude and Saudi production changes suggests, the production cuts implemented during the past 12 months are working to support crude oil prices (Exhibit 50). Beyond the OPEC+ put, we also note there are other buffers should prices fall. Looking at the Strategic Petroleum Reserve, we note that the US government could come in to buy between 100 and 250mn barrels at $67-72/bbl for WTI (Exhibit 51). Lastly, we have previously mentioned that higher domestic coal production costs in China should help to set a floor global energy prices.

Exhibit 50: Brent crude oil price and Saudi production changes
As the most recent interaction between Brent crude and Saudi production changes suggests, the cuts are working to support prices



Source: Bloomberg

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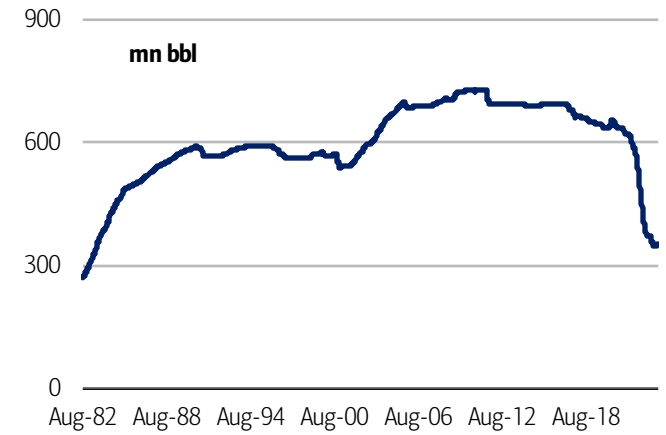
Exhibit 51: US Strategic Petroleum Reserve
Looking at the Strategic Petroleum Reserve, we note that the US government could come in to buy between 100 and 250mn barrels at $67-72/bbl for WTI



Source: Bloomberg

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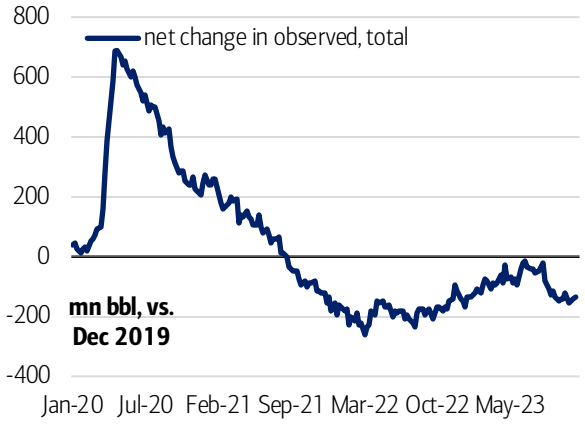
Commercial oil stocks may fall further on Saudi cuts

Reduced stocks are, for starters, an important source of asymmetric support to the global oil complex. Looking at oil inventories globally via satellite, we note that commercial crude stocks declined by 132 mn barrels in 3Q23 from December 2019 and continue to draw this quarter (Exhibit 52), which in turn has been a key factor pushing the Brent crude oil market into steepening backwardation (Exhibit 53). In our view, tight crude oil inventories, coupled with a firm commitment by Saudi to keep the global oil

market tight, should support Brent crude prices and we reiterate our $90/bbl Brent baseline forecast for 2024.

Exhibit 52: Observed change in petroleum inventories
Looking at oil inventories globally via satellite, we note that they these have declined by 132mn barrels in 3Q23 from Dec 19 and continue to draw...



Source: Kayrros, EIA, Bloomberg, Clarksons, BofA Global Research estimates

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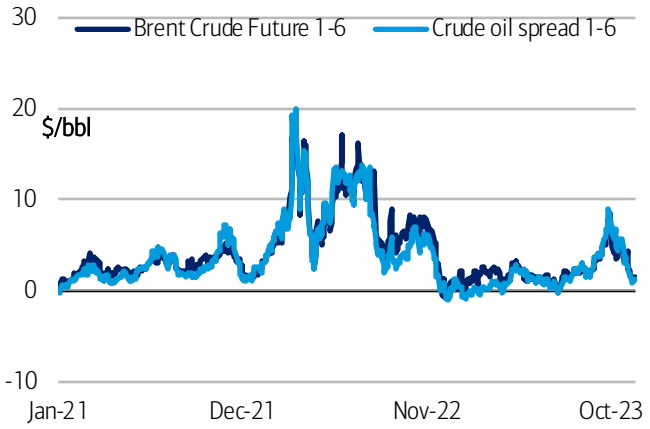
Exhibit 53: Crude oil timespreads
...which turn was a key factor pushing the Brent crude oil market into steeper backwardation in 3Q



Source: Bloomberg

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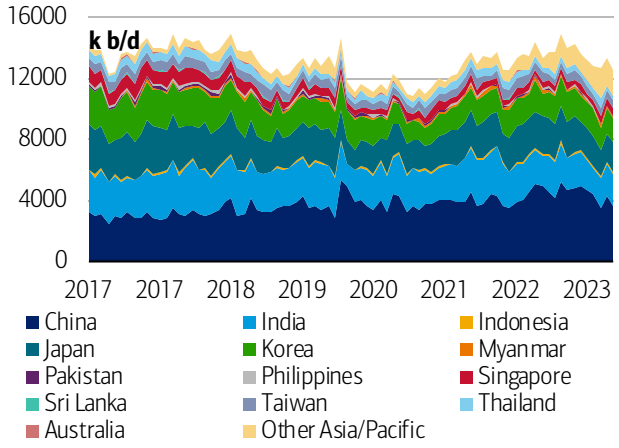
Under a contained conflict, Brent may near $95/bbl...

Even then, we believe the crude market may be too sanguine about recent developments in the Middle East. True, Persian Gulf OPEC crude oil exports to Asia declined in recent months as Saudi Arabia cut production to support the market (Exhibit 54), but the dependence of Asian economies on oil flowing through the Strait of Hormuz is enormous. And while we expect a relatively balanced global oil market in 2024 after experiencing significant deficits in 2H23 (Exhibit 55), we believe prices will hold at around $90/bbl over the next 12 months even if the Israel-Palestine conflict is contained.

Exhibit 54: Persian Gulf OPEC crude oil exports to Asia
Persian Gulf OPEC crude oil exports to Asia have declined in recent months as Saudi Arabian cut production to support the market



Source: Bloomberg

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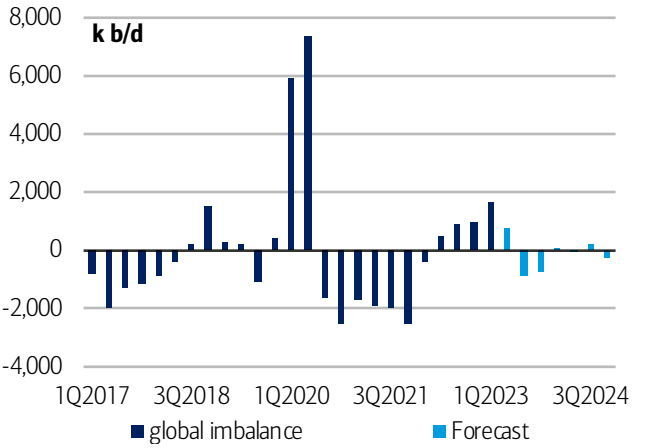
Exhibit 55: Global oil surplus
We expect a relatively balanced global oil market in 2024 after experiencing significant deficits in the second half of 2023



Source: IEA, BofA Global Research estimates

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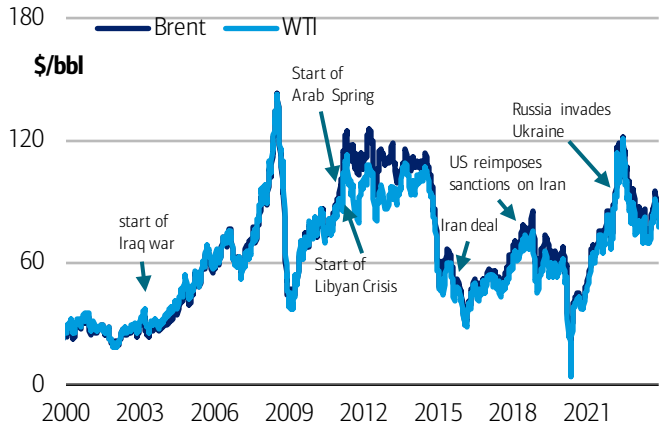
...but any escalation could trigger a jump to $130/bbl

Any modest military escalation is likely to rattle global crude markets, as comments by the Iranian foreign minister in Riyadh last month about a potential Israel oil embargo suggest. Looking at recent history, we note that Middle East tensions led to meaningful oil prices increases of 11%, 27% and 25%, respectfully, within the first ninety days of

Iraq, the Arab Spring, and Libya (Exhibit 56) in the last two decades. And while the US is energy independent and will likely suffer less than Europe or Japan if energy supply losses start to mount, the rapid change in perceptions about the Middle East has already altered the volatility smile in global oil markets, with oil risk reversals now showing a marked call skew (Exhibit 57).

Exhibit 56: Brent and WTI prices and Middle East tensions
Looking at recent history, we note that Middle East tensions led to meaningful oil prices increases of 11% to 27% within the first ninety days of the conflicts



Source: Bloomberg, BofA Global Research

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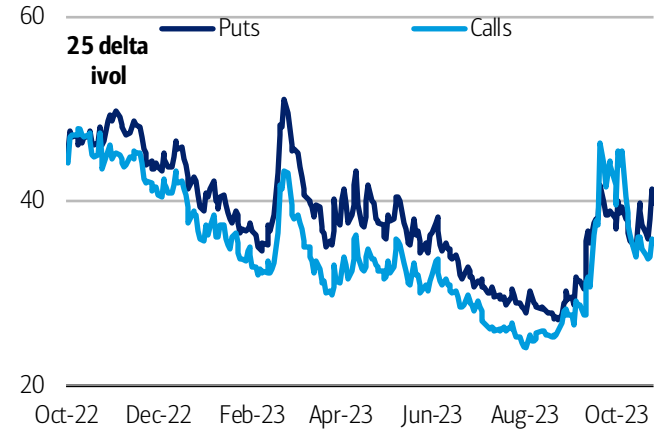
Exhibit 57: Brent m1 25d call ivol and 25d put ivol
The rapid change in perceptions around the Middle East briefly altered the volatility smile in global oil markets, with oil risk reversals showing call skew in October



Source: Bloomberg

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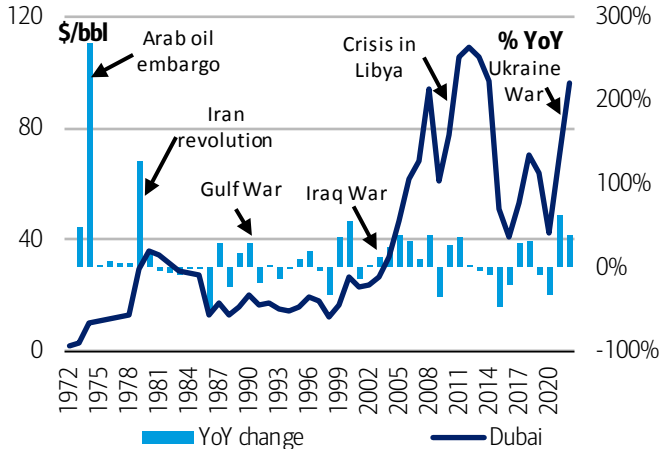
Should oil disruptions occur, prices may spike further

Looking farther back at major oil output disruptions in the past six decades, we note that energy supply shocks such as the Arab oil embargo and the Iran revolution led to triple-digit percentage increases in global oil prices in 1973 and 1980, respectively (Exhibit 58). Note that those jumps in prices were substantially more damaging to the global economy than the subsequent events discussed in the prior paragraph. Yet, it is also important to remember that these sharp upward moves, coupled with recession and pandemic, eventually flattened OECD oil consumption (Exhibit 59) over a number of decades.

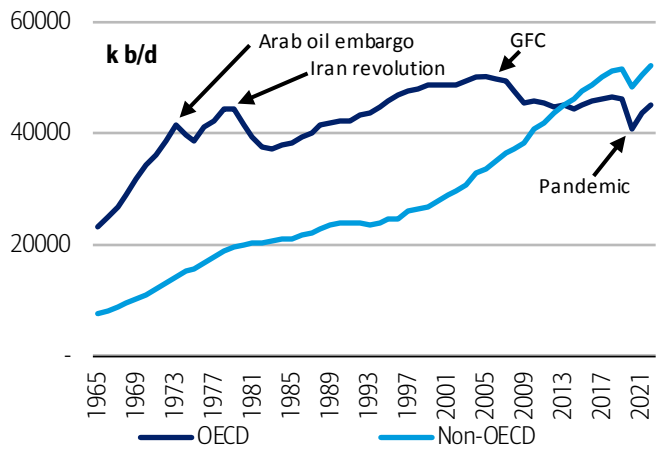
Exhibit 58: Dubai oil prices
Major oil supply disruptions in the past led to triple digit percentage increases in global oil prices, particularly in the 1970s...



Source: Energy Institute, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 59: OECD and non-OECD oil consumption
...although these sharp upward moves, coupled with recession and pandemic, eventually flattened OECD oil consumption



Source: Energy Institute, BofA Global Research

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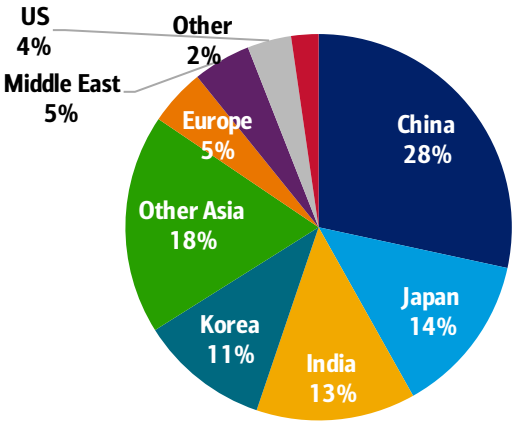
A Suez Canal disruption would extend oil supply chain

While all eyes have been on the Strait of Hormuz in recent weeks, we believe there are also risks emanating from potential disruptions to the Suez Canal. Historically, a majority of oil exports from the Persian Gulf would go to China, Japan, India, South Korea and other Asian countries (Exhibit 60), but more recently the Suez Canal has seen huge growth in energy flows as a result of the collapse in Russian crude oil and petroleum product exports to Europe (Exhibit 61). Increased European dependency in oil products from the Middle East creates asymmetric risks for gasoil cracks even as global growth continues to slow down.

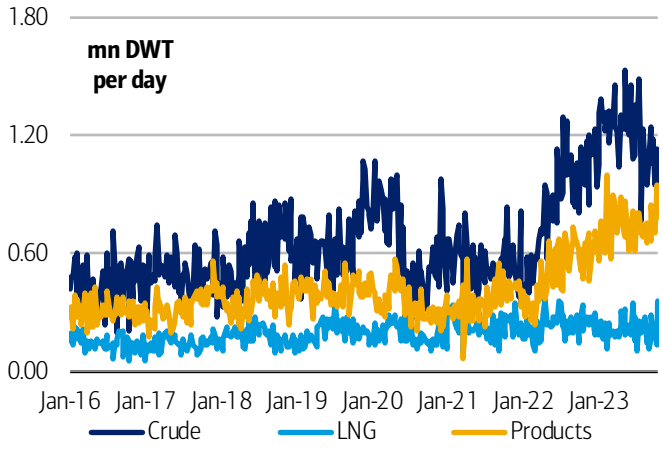
Exhibit 60: Persian Gulf OPEC crude oil exports by country/region
Historically, a majority of oil exports from the Persian Gulf would go to China, Japan, India, South Korea and other Asian countries but...



Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 61: Crude, product, and LNG tankers transiting the Suez Canal
...more recently the Suez Canal has seen huge growth in energy flows because of the collapse in Russian oil exports to Europe



Source: Clarksons

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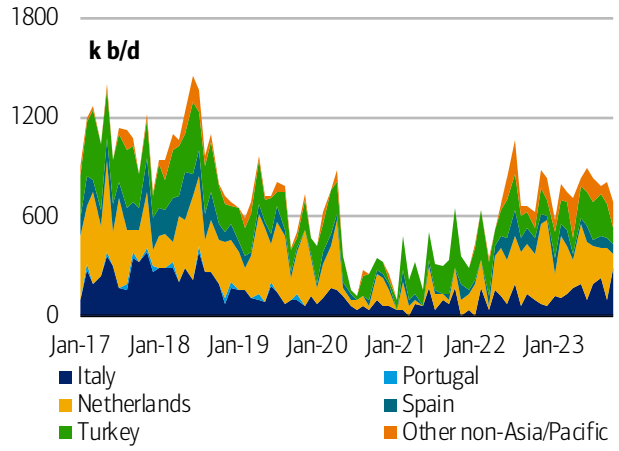
Strait of Hormuz risks may push up tanker premiums

Of course, even a two-week shutdown of the Strait of Hormuz that knocks off 250mn barrels of global inventories, something that has never happened, would impact just about any oil consumer around the world. It would also be bullish ME freight relative to other routes, as tankers would command a premium due to vessel seizure or damage risk. Taking the Black Sea freight blowout during 2022 as a reference, we believe transit costs could increase by $5 or more. Still, European crude oil imports from the Persian Gulf have increased since Russian imports were banned but remain low compared to the dependence on Asia (Exhibit 62). Instead, daily transit of crude and petroleum products through Suez has almost doubled compared to the period before the Ukraine war (Exhibit 63).

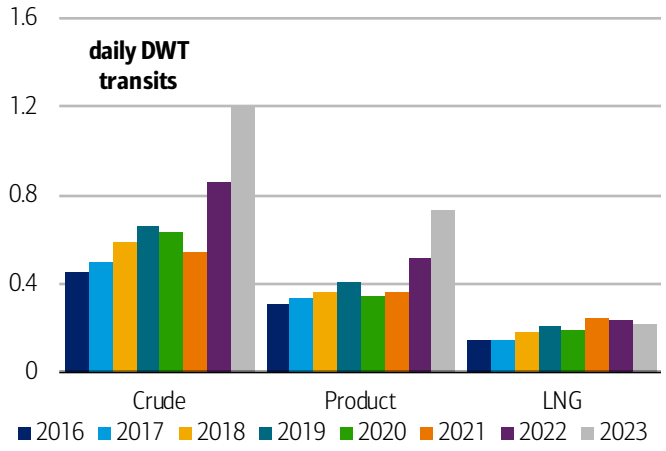
Exhibit 62: Persian Gulf OPEC crude oil exports to Europe
European crude oil imports from the Persian Gulf have increased, but remain low compared to the dependence on Asia



Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 63: Crude, product, and LNG tankers transiting the Suez Canal
Instead, daily transit of crude and petroleum products through Suez has almost doubled compared to the period before the Ukraine war



Source: Clarksons

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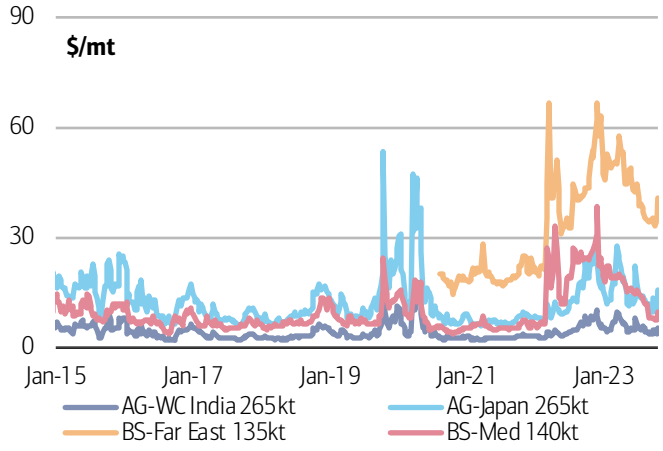
Oil market implications would include tighter sours...

Any Suez-related disruption would force ships to go around the Cape of Good Hope in South Africa, further extending global oil supply chains and would be bullish for all tanker freight. Still, Suez losses would be bearish East-West spreads, as shipping to Europe would suddenly turn more costly and products heading into NEW would need to price higher to account for higher freight costs. Not surprisingly, dirty tanker rates from the Arab Gulf and the Black Sea have rebounded higher during the past few weeks on increased risks (Exhibit 64). Still, a combination of weaker macro growth and weaker winter gasoline crack spreads has started to weigh on refining margins (Exhibit 65), a trend that could reverse if product flows are disrupted.

Exhibit 64: Dirty tanker rates from Arab Gulf and Black Sea
Dirty tanker rates from the Arab Gulf and the Black Sea have rebounded higher during the past few weeks on increased risks



Source: Clarksons

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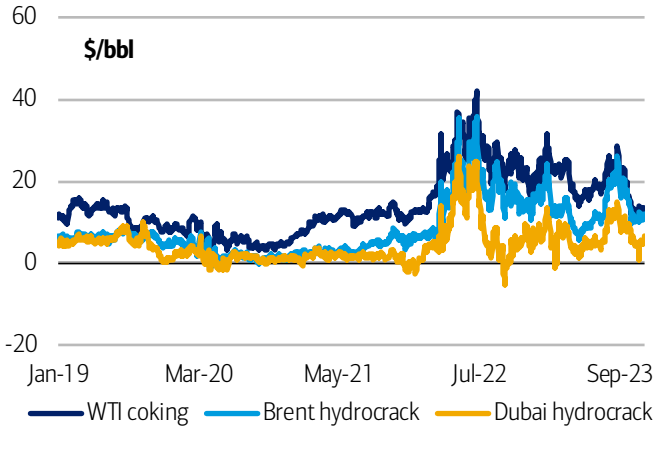
Exhibit 65: Regional refining margins
A combination of weaker macro growth and weaker winter gasoline crack spreads has started to weigh on refining margins



Source: Bloomberg

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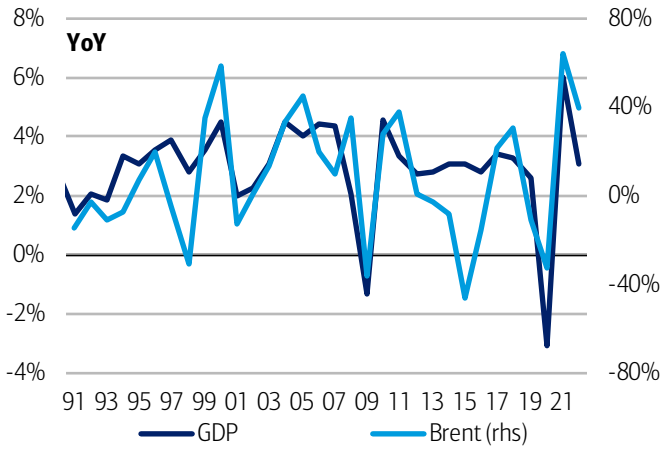
...and a steepening term structure for Brent and WTI

In sum, a key oil market implication of any Middle East disruption is that Brent-Dubai could strengthen to account for more expensive logistics, but it could also play out in other regional spreads with US Mars likely outperforming Dubai as Persian Gulf freight costs and certainty of supply factor into the equation. It would also impact the term structure and price level of oil. World GDP and Brent price growth have been closely

connected for decades, except when Saudi fought a price war with US shale (Exhibit 66). Falling inventories and Middle East tensions briefly steepened the term structure of Brent crude last month (Exhibit 67), a dynamic that could re-emerge if tensions escalate again.

Exhibit 66: World GDP and Brent price growth
World GDP and Brent price growth have been closely connected for decades, except when Saudi fought a price war with US shale



Source: IMF, Bloomberg

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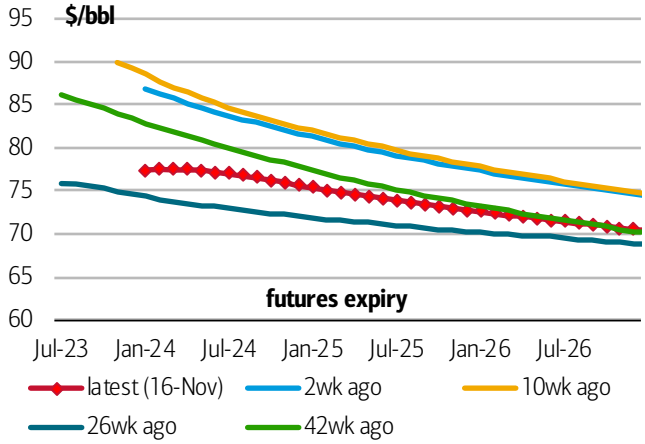
Exhibit 67: Brent forward curve
Falling inventories and Middle East tensions have contributed to steepen the term structure of Brent crude in recent weeks



Source: Bloomberg

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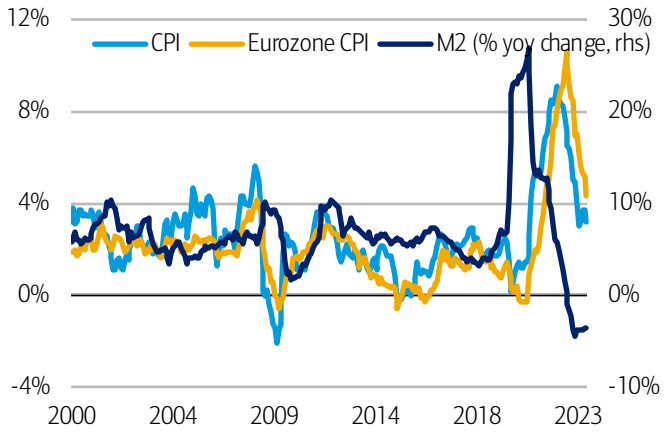
Yet a worsening macro outlook may hurt consumption

Even as supply disruption risks continue to influence the oil market, it is also worth pointing out that a worsening macro outlook could hurt consumption over the coming months. Looking at US money supply, we also note that there has been a steep contraction in monetary aggregates, an ominous sign that could spell trouble ahead for the economy (Exhibit 68). Historically, excessive monetary policy tightening has eventually been followed by a recession (Exhibit 69), and our global oil demand forecast already points to meaningful deceleration in growth from 2.1 mn b/d year-on-year growth in 2023 to 1.1mn b/d in 2024 as the world economy slows down.

Exhibit 68: US money supply and CPI and Eurozone CPI
Looking at US money supply, we note that there has been a steep contraction in monetary aggregates, an ominous sign



Source: Bloomberg

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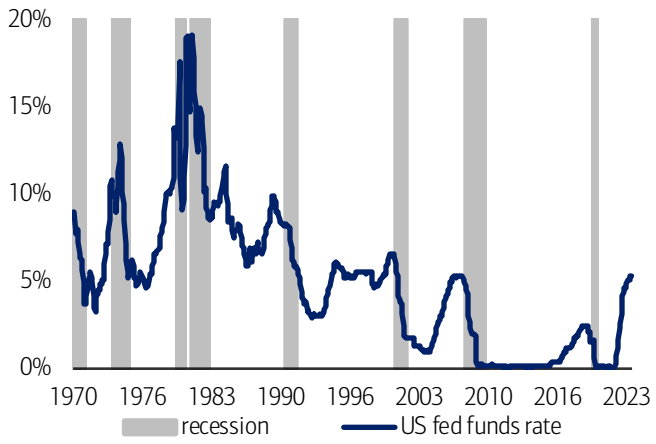
Exhibit 69: US fed funds rate and recessions
Historically, excessive monetary policy tightening has eventually been followed by a recession



Source: Bloomberg

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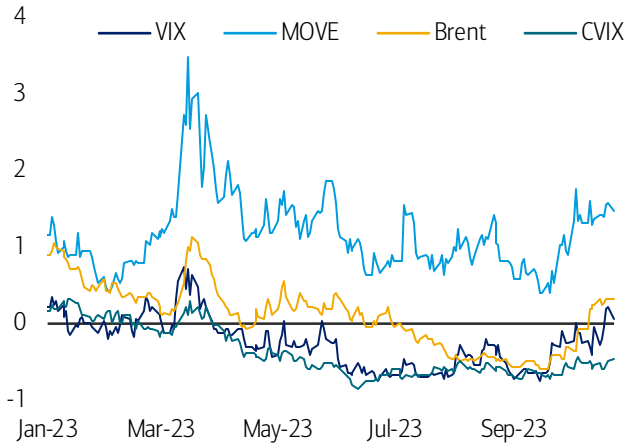
Higher rates, uncertainty pushed up oil volatility...

True, we still believe global oil demand growth rates ahead are reverting back to pre-COVID trends, not contracting, but we also highlight the rising uncertainty ahead. While

rates volatility remains very high, volatility in the equity markets has only bounced up modestly just as WTI vol recovered from the lows (Exhibit 70). Meanwhile, the rapid increases in interest rates are already signalling tighter lending standards across the United States, according to the Fed (Exhibit 71). This combination of rising interest rates and rising volatility will not likely mix well with a big spike in oil prices should events in the Levant lead to one.

Exhibit 70: Z-score of cross-asset implied volatility since 2006

While rates volatility remains very high, volatility in the equity markets has only bounced up modestly just as WTI vol has recovered from the lows



Source: BofA Global Research, Bloomberg

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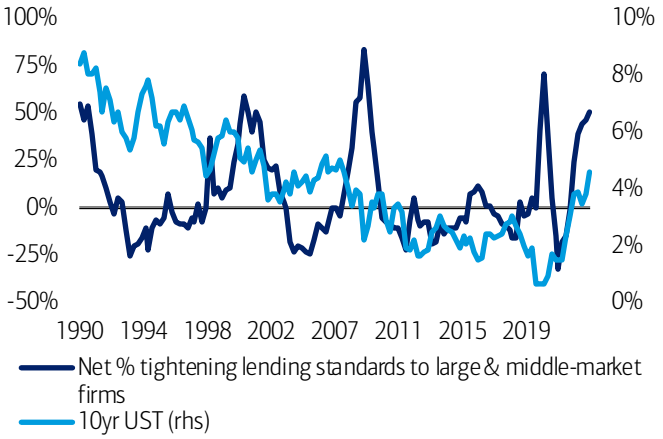
Exhibit 71: Senior loan officer opinion survey on net tightening lending standards to large and middle-market firms and 10 year US treasury yield

Meanwhile, the rapid increases in interest rates are already signalling tighter lending standards across the United States, according to the Fed



Source: Federal Reserve, Bloomberg

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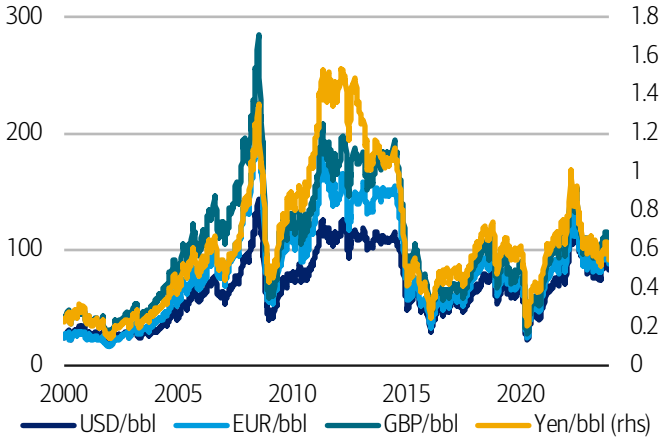
...and the strong dollar is further eroding oil demand

Moreover, the rapid increase in US interest rates, particularly relative to other G10 economies, has driven up the US dollar, making oil more expensive in EUR or JPY (Exhibit 72). The increased cost of oil in local currency will likely dent oil at the margin, although oil as a share of income is not yet very expensive compared to prior decades. In fact, we also note that gasoline prices relative to US average hourly earnings are not disproportionately high compared to history (Exhibit 73), suggesting that oil demand will likely hold up if the broader macro economy does.

Exhibit 72: Historical Brent prices by currency

The rapid increase in US interest rates, particularly relative to other G10 economies, has driven up the US dollar, making oil more expensive in EUR or JPY



Source: Bloomberg, BofA Global Research

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Exhibit 73: US gasoline prices relative to average hourly earnings

Even then, we note that gasoline prices relative to US average hourly earnings are not disproportionately high compared to history

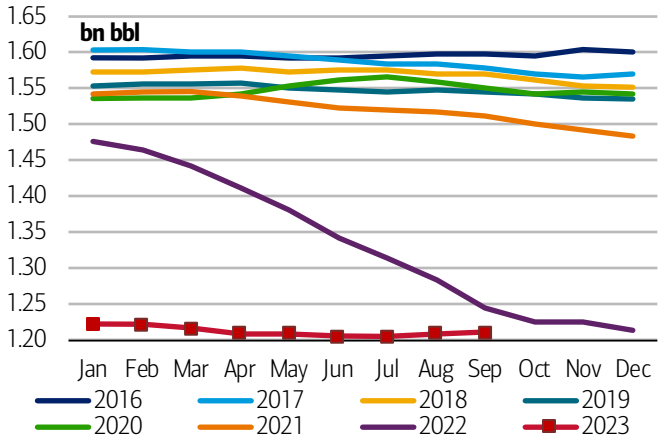
Source: Bloomberg

BofA GLOBAL RESEARCH

OECD strategic oil reserves are low, but not in China

The one factor that creates additional asymmetric risks to the upside in global oil markets is the starting level of inventories coupled with the declining profile of oil stocks. According to the latest International Energy Agency data, strategic oil reserves across the OECD are actually very low compared to history (Exhibit 74). This worrisome trend means that advanced economies could be very negatively impacted in the case of additional oil disruptions over the coming months. Yet Chinese total oil inventories are only slightly below the highs, suggesting China is a bit better prepared to deal with supply dislocation (Exhibit 75).

Exhibit 74: OECD government petroleum stocks
According to the latest International Energy Agency data, strategic oil reserves across the OECD are actually very low compared to history...



Source: IEA

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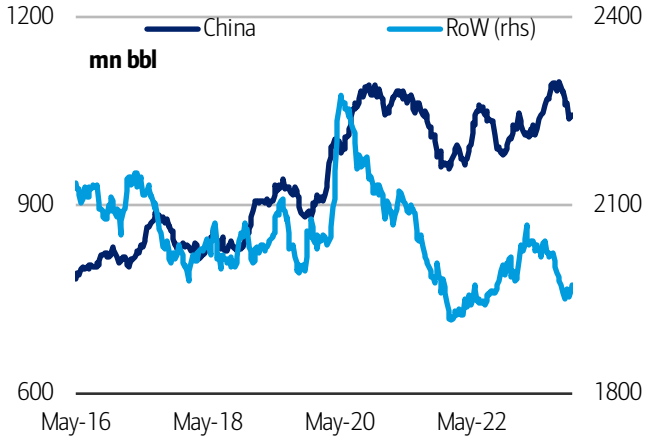
Exhibit 75: Aboveground crude oil inventories (Kayrros)
...but Chinese total oil inventories are only slightly below the highs, suggesting China is a bit better prepared to deal with an oil supply disruptior



Source: Kayrros

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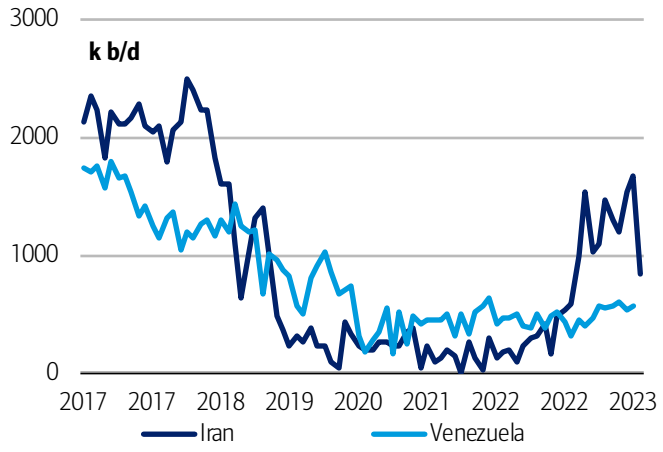
Tighter Iran sanctions are also a major risk to oil that...

Beyond the potential risks associated with conflict-linked disruptions, economic warfare is perhaps a more visible risk for oil markets in the upcoming weeks. After all, Iranian crude oil exports have increased during the past few months as the US government reduced pressure on sanctions (Exhibit 76), allowing Iranian oil volumes reaching the world markets to grow from an average of 0.2 mn b/d two years ago to 1.3mn b/d through October. If the US tightens rules on these barrels, oil prices would rise. Still, falling Iranian oil supplies have been offset by rising Saudi production and vice versa (Exhibit 77) in the past.

Exhibit 76: Crude oil exports from Iran and Venezuela
Iranian crude oil exports have increased during the past few months as the US government reduced pressure on sanctions



Source: Bloomberg

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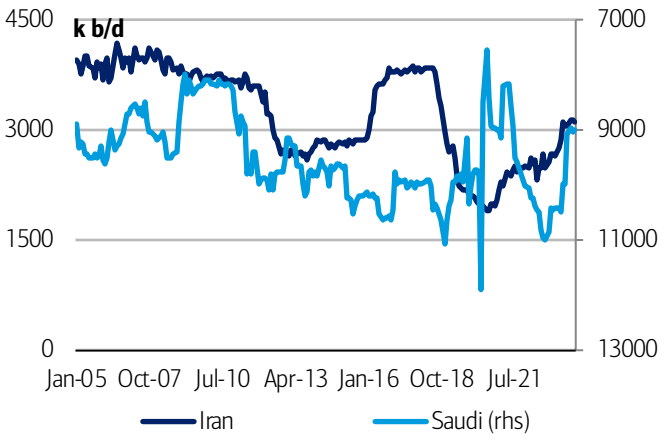
Exhibit 77: Saudi and Iran crude oil production
In the past, falling Iranian oil supplies have been offset by rising Saudi production and vice versa



Source: IEA

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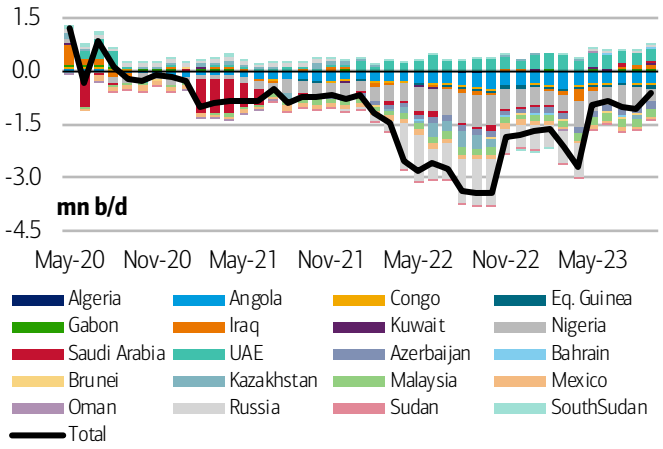
...could be partly offset by Saudi, but at higher prices

In our view, while tighter Iran sanctions are a major risk to oil prices, it is also true that OPEC+ has reversed much of the production increases observed during the last three and a half years by taking ~5mn b/d away from the market from the highs (Exhibit 78). So now Saudi Arabia and the UAE hold substantial crude oil spare production capacity as a result of these cuts, a factor that could temper any run-up in prices above $100 or $110/bbl (Exhibit 79).

Exhibit 78: OPEC+ production versus quotas
OPEC+ has reversed much of the production increases observed during the last three and a half years by taking ~5mn b/d away from the market from the highs...



Source: IEA, OPEC, BofA Global Research estimates

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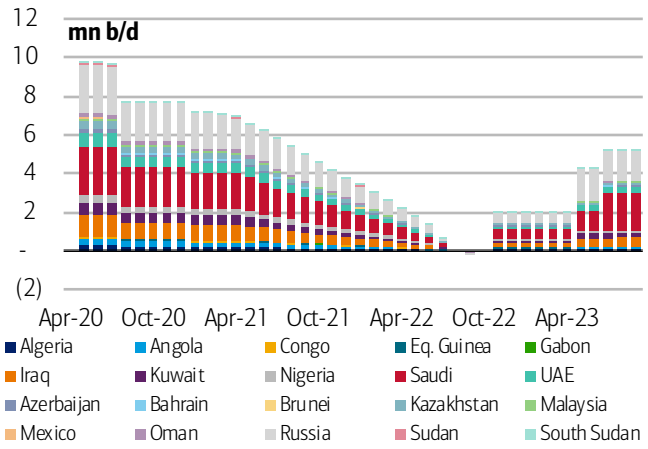
Exhibit 79: OPEC+ production cuts (mandated & voluntary)
...but now Saudi Arabia and the UAE hold substantial crude oil spare production capacity as a result of these cuts, a factor that could temper prices



Source: OPEC, BofA Global Research estimates

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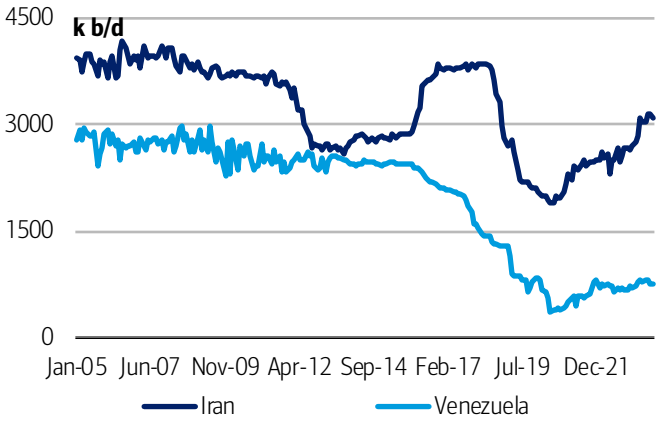
Venezuelan production could also help at the margin

Another source of oil that could help neutralize Middle East tensions at the margin is Venezuela. But even after the last month's US Treasury announcement, we remain sceptical that Venezuela could increase production much above the current levels of ~800 thousand b/d and we project volumes of 950k b/d next year (Exhibit 80), just 150k b/d above this year's levels. Still, armed with 3.3mn b/d of spare production capacity outside Iran, there is a lot of room to put a lid on oil prices if other volumes are lost elsewhere (Exhibit 81).

Exhibit 80: Iran and Venezuela crude oil production
We remain skeptical that Venezuela could increase production much above the current levels of ~800 thousand b/d and project volumes of 950k b/d next year



Source: IEA

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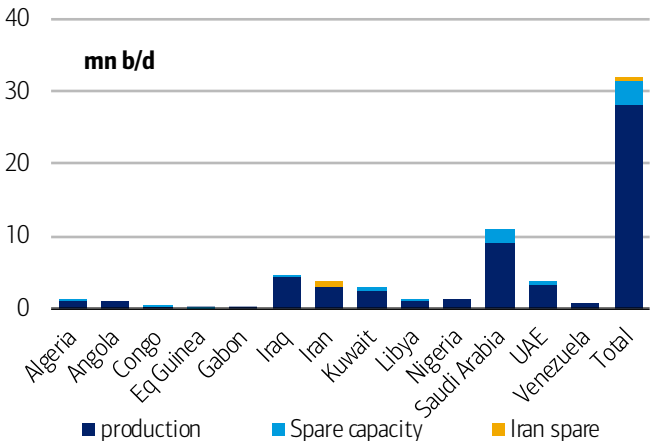
Exhibit 81: OPEC production capacity
Still, armed with 3.3mn b/d of spare production capacity outside Iran, there is a lot of room to put a lid on oil prices if other volumes are lost elsewhere



Source: IEA, BofA Global Research estimates

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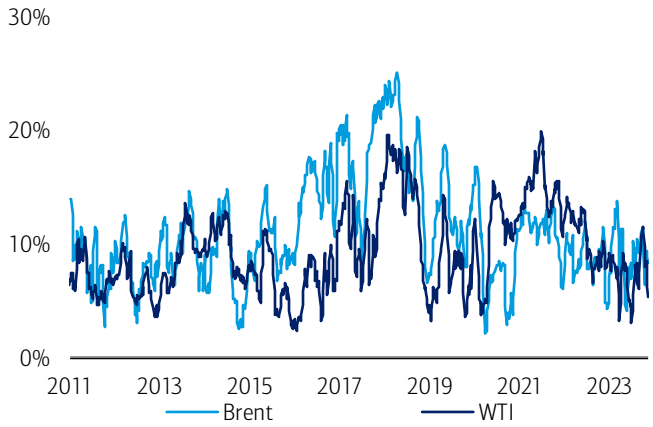
Oil money positions have shifted, but not sufficiently…

Beyond the fundamentals, oil money positions have increased modestly in the Brent/WTI crude oil market during the past few weeks, contributing to lift prices (Exhibit 82), but the run-up in speculator interest has not been remarkable by historical standards. In our view, oil money positions have plenty of room to grow over the coming weeks as fund managers and asset owners recalibrate their portfolios. After all, oil price inflation has tended to precede retail or consumer price inflation in countries like the US or Britain (Exhibit 83).

Exhibit 82: CFTC and ICE managed money positioning for Brent and WTI crude oil

Oil money positions have increased modestly in the Brent/WTI crude oil market during the past few weeks, contributing to lift up prices…



Source: CFTC, ICE

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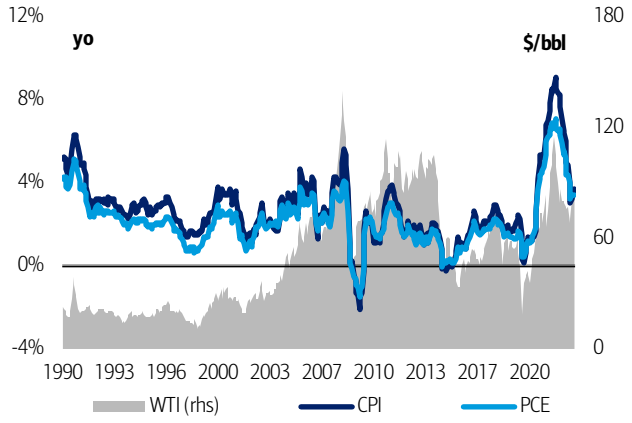
Exhibit 83: US year-on-year headline CPI and PCE inflation and front-month WTI crude oil futures prices

…and oil price inflation has tended to precede retail or consumer price inflation in countries like the US or Britain



Source: BLS, BEA, Bloomberg

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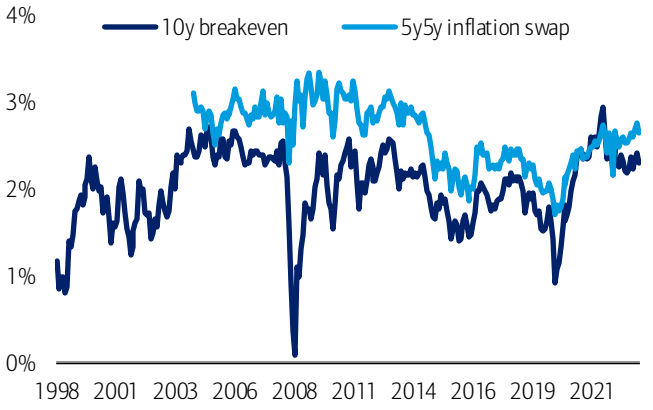
…to hedge unexpected inflation in multi-asset funds

Given the continued upward pressure on interest rate instruments such as US 5y5y forward inflation and US 10yr breakevens (Exhibit 84) to 2.7% and 2.3%, respectively, in the past month, we believe there is plenty of room for investors to scale up commodity exposure from ~$208 bn at present back to historical highs of ~$350 bn (Exhibit 85). Our equity derivatives team has noted that the correlation between equities and bonds has turned positive in the past two years, in turn making oil and commodities an even more important diversifier in multi-asset portfolios. With commodities now yielding a positive roll return, we believe oil is under-owned as a tool to hedge unexpected inflation.

Exhibit 84: US 10-year inflation breakeven and 5-year forward inflation swaps

We note the continued upward pressure on interest rate instruments such as US 5y5y forward inflation and US 10yr breakevens…



Source: Bloomberg

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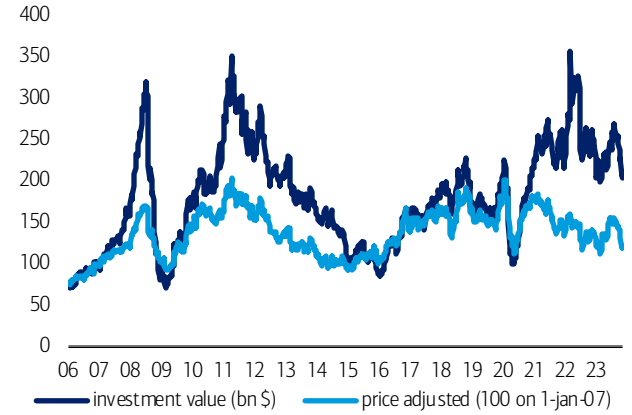
Exhibit 85: Commodity index tracking assets under management

…and believe there is plenty of room for investors to scale up commodity exposure from $208bn at present back to historic highs of $356bn



Source: BofA Global Research, Bloomberg

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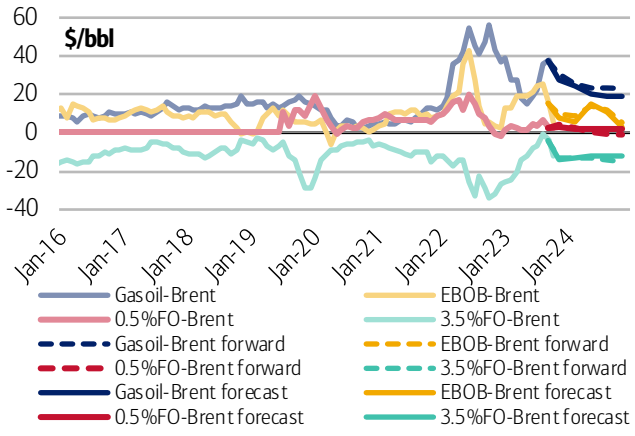
2.2 Refined products

Middle distillates support margins near term, cracks likely to weaken in 2024

We lift our gasoline and diesel cracks forecasts for 2024 due to refinery hiccups and delays, resilient demand, low inventories, and persistent OPEC+ cuts (see our report, Diesel weasels out of a cyclical downturn). Yet, we stay bearish versus the curve (Exhibit 86 and Exhibit 87) as refining capacity catches up with demand. We see NYH ULSD and RBOB cracks vs Brent averaging $26/bl and $13/bbl respectively in 2024. Ahead of winter, diesel cracks are vulnerable to upside moves due to low stocks, and RBOB-ULSD should outperform the curve next summer. HSFO-Brent cracks rolled over, driven partly by seasonal demand weakness and turnarounds (see our report, In the fuel oil market, high sulfur is king), and should average -$12/bbl next year, while VLSFO-Brent cracks average $2/bbl on ramping supply.

Exhibit 86: NWE refined product cracks – history, forecasts, and forwards

We lift our gasoline and diesel cracks forecasts for 2024 on refinery hiccups and delays, resilient demand, low inventories, and persistent OPEC+ cuts



Source: Bloomberg, BofA Global Research estimates

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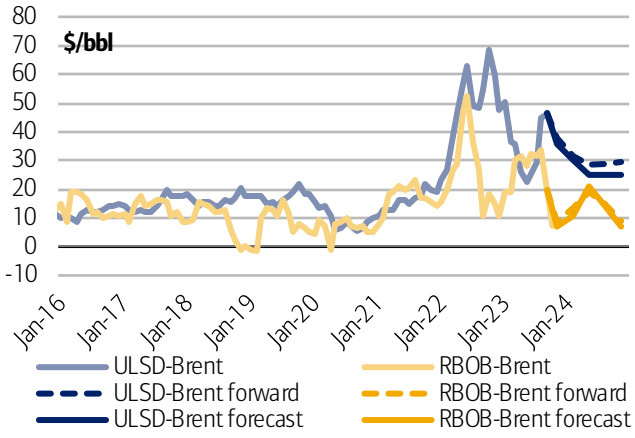
Exhibit 87: NYH refined product cracks – history, forecasts, and forwards

Yet, we stay bearish versus the curve as refining capacity should catch up with demand



Source: Bloomberg, BofA Global Research estimates

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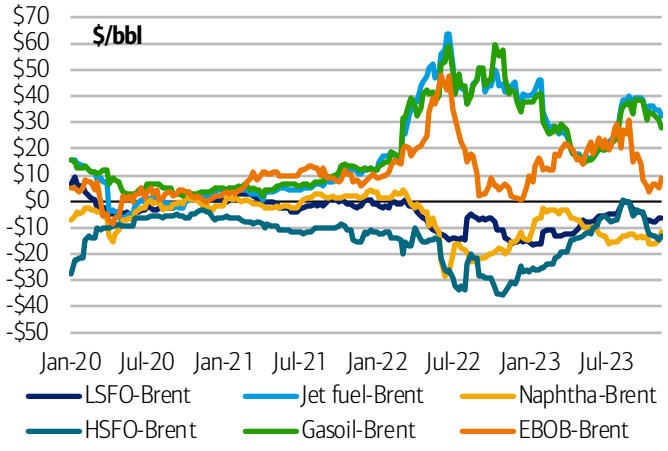
Gasoline and fuel oil cracks collapsed, as diesel and jet buoyed refining profits…

Extreme moves in refined product cracks continued this year, with gasoline and HSFO cracks marching steadily higher into summer, with the former rising from a low of -$35/bbl in December 2022 to a high of roughly -$3.50/bbl in July (Exhibit 88). Gasoline cracks reached $0/bbl in December before staging a rally to $30/bbl as summer driving season peaked. Then, middle distillate cracks took over, with jet fuel and diesel cracks topping $40/bbl In August and remaining relatively buoyant through October as gasoline and fuel oil cracks started to collapse. Until recently, refinery margins have been surprisingly strong, but continued gasoline and fuel oil weakness have meant that middle distillates are all that's left supporting margins and preventing some refiners from cutting runs (Exhibit 89).

Exhibit 88: NWE refined product cracks
Gasoline and fuel oil cracks have all moved lower since July, while middle distillate cracks have held up relatively well



Source: Bloomberg

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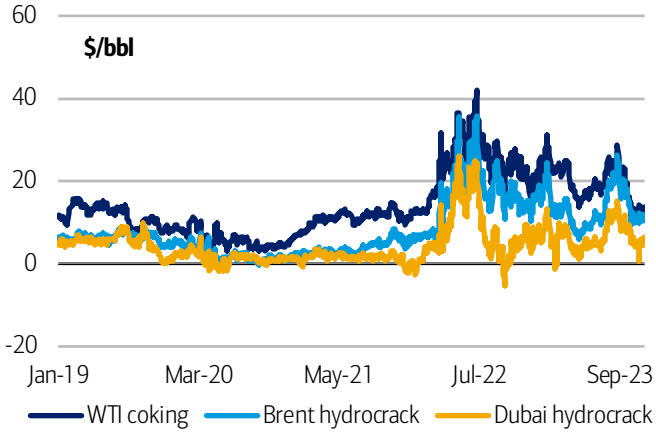
Exhibit 89: Refinery Margins
Even so, refining margins have come down from the summer highs and pose a threat to refinery runs in some regions



Source: Bloomberg

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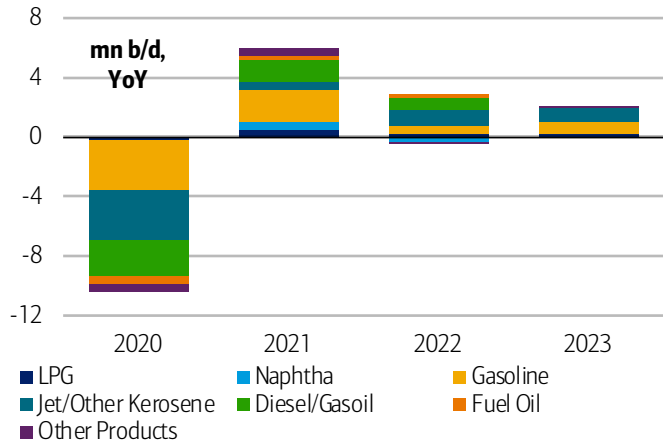
...due in part to a steady recovery in air travel and jet fuel demand...

The post-pandemic recovery in oil demand was diversified across all fuels to start but became very middle distillate oriented in 2022, with diesel and jet fuel demand rising by an estimated 1.9mn b/d YoY, according to Woodmac, while gasoline and naphtha demand rose just 100k b/d (Exhibit 90). In 2023, middle distillates again topped naphtha and gasoline, albeit by a smaller margin. The re-opening in China helped boost international air travel, offsetting soft diesel demand, while flattish naphtha demand growth left gasoline to drive light distillate demand of just 800k b/d. The continued outperformance of middle distillate demand has helped prop up refining margins recently, while gasoline, naphtha, and the fuel oils have all been a drag on economics (Exhibit 91).

Exhibit 90: Estimated Global oil demand growth by product
The post-pandemic recovery in oil demand was diversified across all fuels to start but became very middle distillate oriented in 2022...



Source: Woodmac

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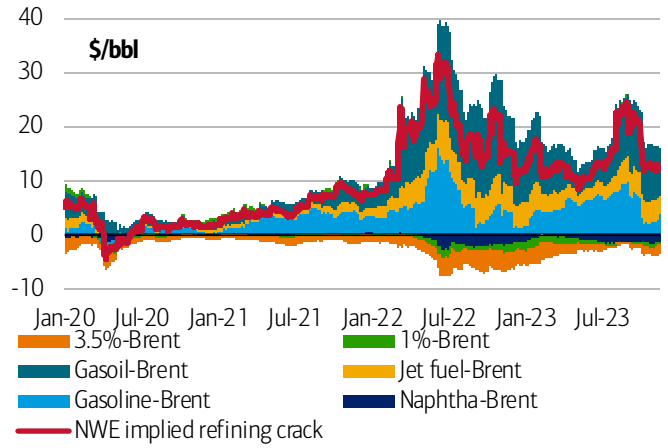
Exhibit 91: Implied NWE refining margins
...which helps explain why middle distillates have helped prop up refining margins in recent weeks



Note: Composition represents Brent, naphtha, gasoline, jet fuel, diesel, LSFO, HSFO in a ratio of 10:1:3:1:3:1:1. **Source:** Bloomberg, BofA Global Research estimates

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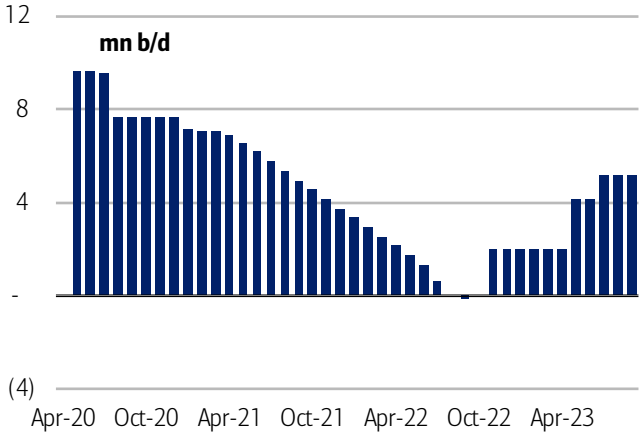
...and OPEC+ cuts and refinery delays, outages, and inefficiencies

In addition to the recovery in jet fuel demand, refinery margins have been supported by OPEC+ supply cuts (Exhibit 92), which have removed middle distillate rich crude oil from the market (Exhibit 93). Furthermore, margins have benefitted from the inefficiencies created by the reshuffling of the global crude oil trade, especially in Europe, where

refineries that previously dined on medium sour Urals crude have opted for similar but not identical Middle Eastern supply and light sweet crude from the US. The inclusion of the latter, which typically contains more light ends, has likely contributed to lower diesel yields there. Refineries are typically built to run a specific crude oil or crude quality, so feedstock adjustments made globally have likely contributed to sub-optimal performance recently too. Said another way, refineries may be sacrificing higher utilization rates by running sub-optimal crude slates.

Exhibit 92: Announced OPEC+ cuts
In addition to the recovery in jet fuel demand, refinery margins have been supported by recent OPEC+ supply cuts...



Source: OPEC, BofA Global Research

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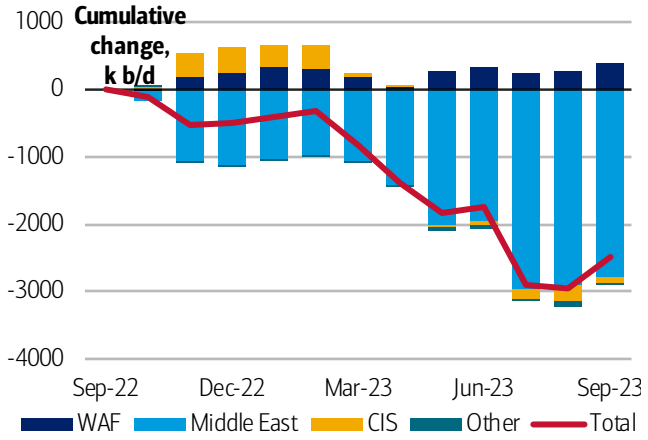
Exhibit 93: Cumulative change in OPEC+ crude supply vs Sep '22
...which have removed middle distillate rich Middle Eastern crude oil from the market



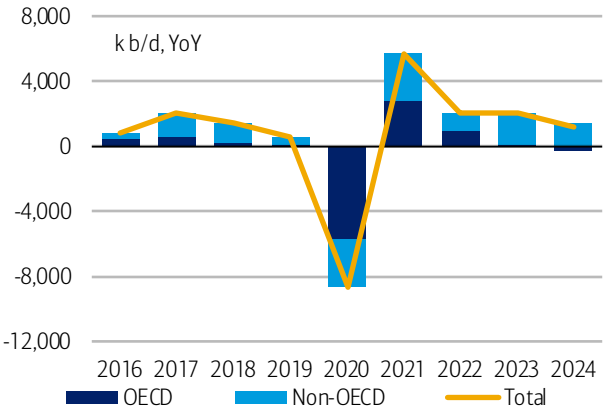
Source: IEA, BofA Global Research

BofA GLOBAL RESEARCH

Oil demand growth to slow, remain middle distillate centric in 2024

Global oil demand growth has proved resilient in 2023, in-line with global economic activity. Indeed, demand is likely to grow as quickly this year as in 2022, owing to the re-opening in China. Asia accounts for nearly all oil demand growth this year and we expect this trend to continue in 2024 too. However, the re-opening effect is likely to be much more muted next year, and we expect the impact of high interest rates will be more visible in the economy by then. As a result, we think demand growth is likely to average just 1.1mn b/d YoY in 2024 (Exhibit 94), led by jet fuel (450k b/d), while gasoline and diesel each grow by roughly 200k b/d (Exhibit 95).

Exhibit 94: Global oil demand growth
Globally, we see demand growth trends slowing down materially from 2mn b/d this year to just 1.1mn b/d next year as the post-Covid recovery fades



Source: IEA, BofA Global Research estimates

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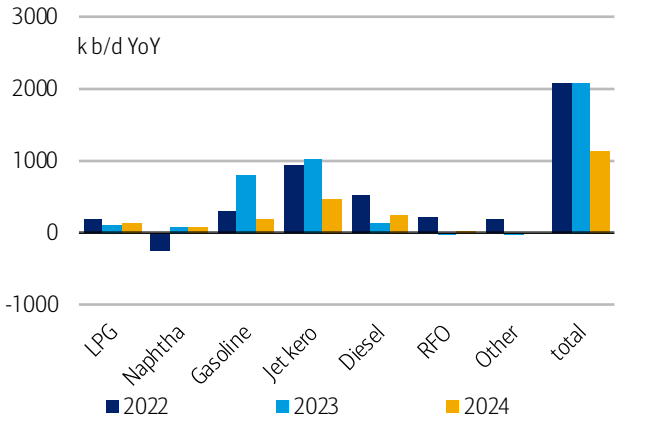
Exhibit 95: Global oil demand growth by product
Looking at different fuels, we continue to believe that transportation will lead oil demand going forward and industrial fuels are likely to grow more slowly



Source: IEA, BofA Global Research estimates

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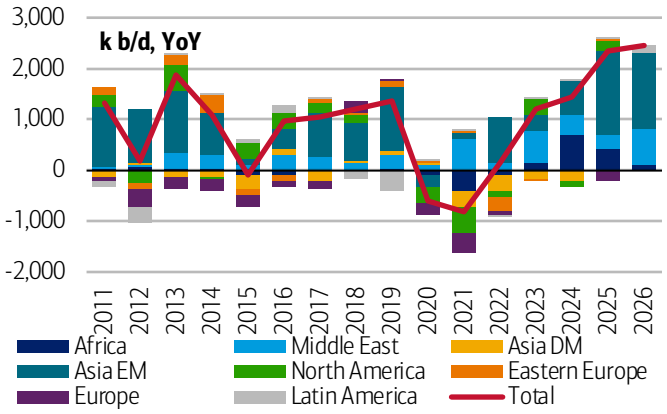
Global CDU capacity to rise 1.45mn b/d and 2.35mn b/d in 2024 and 2025…

Covid-19 tightened the refining system, accelerating closures and delaying new startups. In 2020-21 capacity shrank 1.4mn b/d and only recovered to 2019 levels this year. We update our refining outlook and see CDU growth of 1.2mn b/d YoY in 2023, 1.45mn b/d in 2024, and 2.35mn b/d in 2025 (Exhibit 96). In 2024, Africa accounts for half of capacity growth owing to Nigeria's 615k b/d Dangote refinery and several restarts. China should add 860k b/d in 2025, while South Asia adds ~600k b/d and Dos Bocas boosts Mexico's capacity by 350k b/d. In 2024, we expect global oil demand growth, which includes NGLs and non-refinery fuels, to slow from 2mn b/d to about 1.1mn b/d, which should allow refining capacity to catch up and help pull margins back down to more normal but still elevated levels (Exhibit 97).

Exhibit 96: Global CDU capacity growth by region

We update our refining outlook and see CDU growth of 1.2mn b/d YoY in 2023, 1.45mn b/d in 2024, and 2.35mn b/d in 2025



Source: Platts, BofA Global Research estimates

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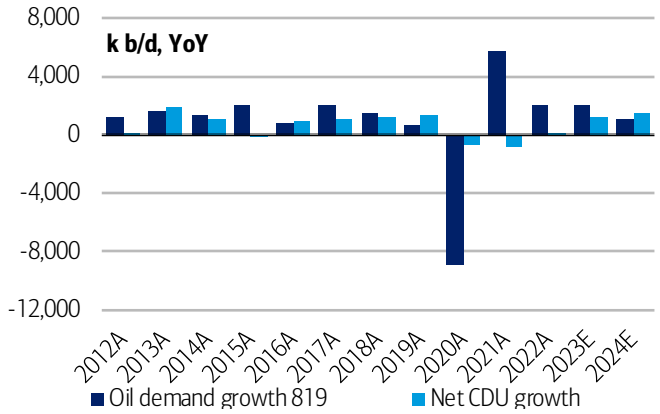
Exhibit 97: Global refining capacity growth and CDU additions

Slower demand growth in 2024 should allow refining capacity to catch up and help pull margins back down to more normal but still elevated levels



Source: Platts, IEA, BofA Global Research estimates

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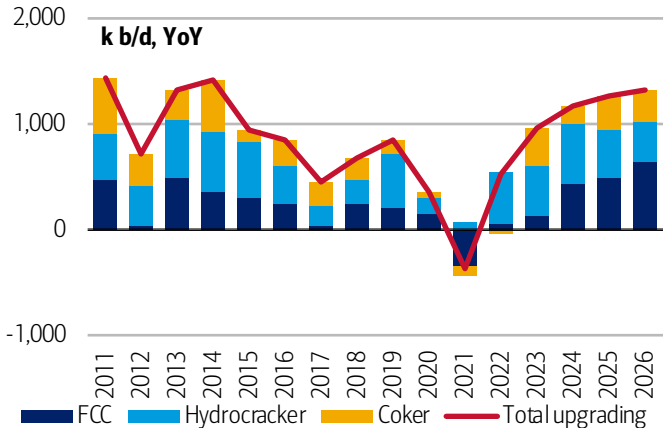
…while upgrading capacity rises 1.2mn b/d in 2024 and 1.3mn b/d in 2025

Global upgrading capacity also contracted during the pandemic, due to roughly 350k b/d of FCC closures (net), but capacity quickly bounced back and now hydrocrack and coker capacity is 1.2mn b/d and 300k b/d above pre-Covid levels, while FCC capacity is nearly fully recovered. We expect upgrading additions (FCC, hydrocracker, coker) of 1.2mn b/d in 2024 and 1.3mn b/d in 2025 (Exhibit 98), driven primarily by Asia (1.1mn b/d). In 2024-25, we see 900k b/d of FCC additions, 1mn b/d of hydrocracker capacity additions, and about 500k b/d of coking capacity (Exhibit 99).

Exhibit 98: Global upgrading capacity growth by unit type
We expect upgrading additions of 1.2mn b/d in 2024 and 1.3mn b/d in 2025...



Source: Platts, BofA Global Research estimates

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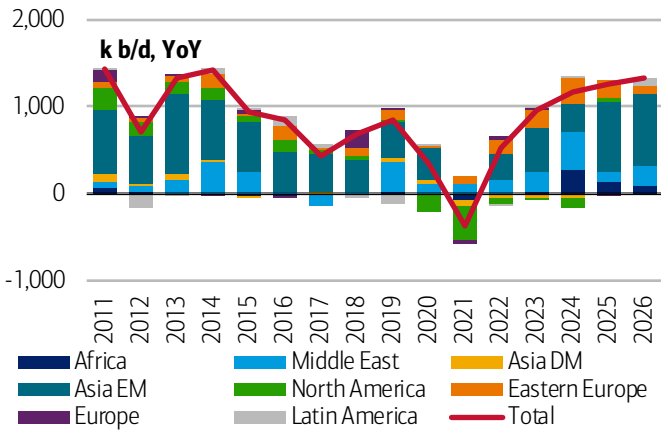
Exhibit 99: Global upgrading capacity growth by region
...driven primarily by Asia (1.1mn b/d) and the Middle East (550k b/d)



Source: Platts, BofA Global Research estimates

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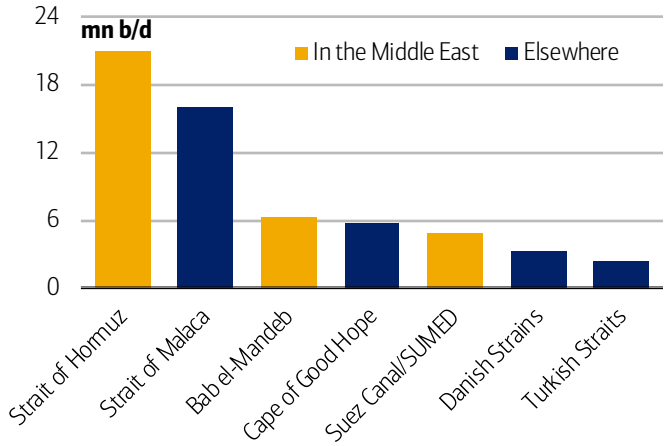
Geopolitics may support margins, drive regional dislocations...

Rising tensions in the Middle East have added risk premium to the petroleum complex, and rightly so (see our report, Geopolitics create oil asymmetries). If shipments through Hormuz, a choke point for nearly 20% of the world's oil and LNG (Exhibit 100), were to shut down for a meaningful period, oil could spike above $250/bbl and LNG could surpass $50/MMBtu. An escalation could also push refining margins higher on the back of potential disruptions to refining activity in the Middle East (~10mn b/d of capacity) or if freight rates increase, pushing spreads between fuel prices in deficit and surplus regions wider (Exhibit 101).

Exhibit 100: EIA chokepoints
A disruption at the Strait of Hormuz or the Suez Canal could curb global availability of crude oil and refined products



Source: EIA (estimates as of 2019), BofA Global Research

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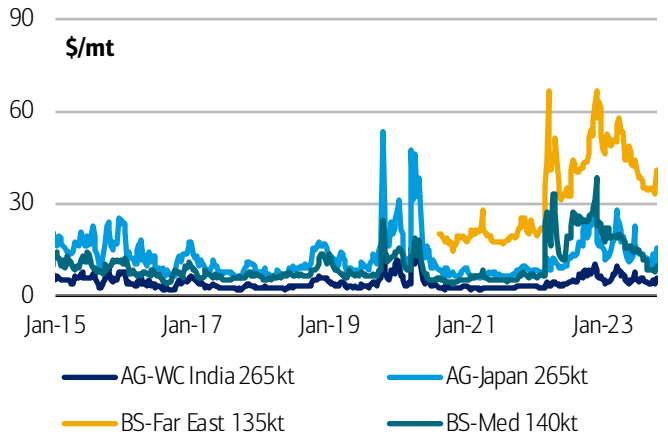
Exhibit 101: Dirty tanker rates from Arab Gulf and Black Sea
An escalation may also push refining margins higher on the back of potential disruptions to refining activity in the Middle East or higher freight rates



Source: Clarksons

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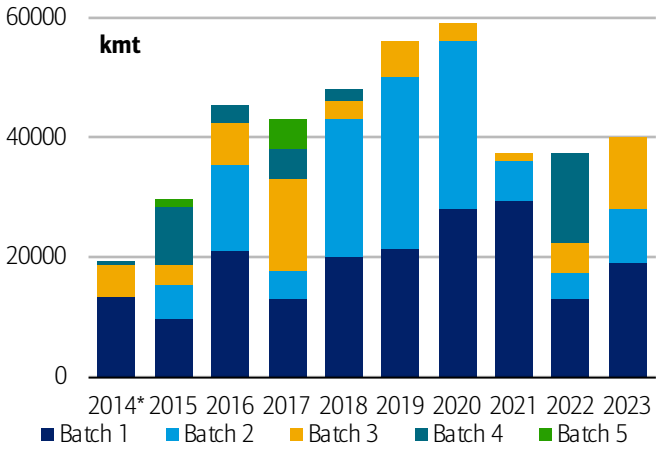
...and China could keep exports and balances tighter next year

China has played a critical role in tightening refined product markets, due to the CCP's decision to cut gasoline, diesel, and jet fuel export quotas by 33% in 2021 (Exhibit 102). Government officials elected to keep export quotas around 40mn mt in 2022-23 as well. The Middle Kingdom's consumption growth is likely to top 1mn b/d YoY this year, or roughly 4x the pace of refining capacity expansions. So, keeping exports in check is likely a prudent decision to avoid any tightness in domestic fuel markets. With domestic refining capacity growth set to barely outpace demand growth next year, it seems likely

that quotas will remain near 40mn mt for gasoline, diesel, and jet fuel in 2024 too. Exports year-to-date have totaled 32mn mt, which leaves just 8mn mt of available quotas remaining this year, assuming no roll over from 2022 (Exhibit 103).

Exhibit 102: China gasoline, diesel, and jet fuel export quotas
China played a critical role in tightening refined product markets, thanks the fuel export quota reductions in 2021 that have persisted into 2023



Source: Platts, BofA Global Research estimates

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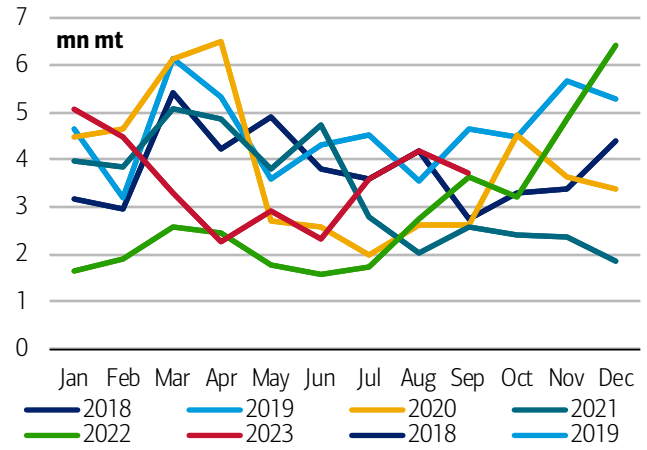
Exhibit 103: China gasoline, diesel, and jet fuel exports
Exports year-to-date have totaled 32mn mt, which leaves just 8mn mt of available quotas remaining this year, assuming no roll over from 2022



Source: Bloomberg

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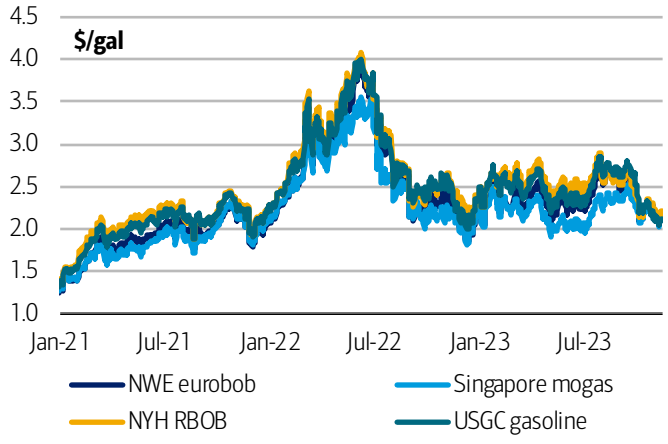
Gasoline

Gasoline prices and cracks sold of sharply post summer season...

Since the highs of summer, gasoline prices have fallen roughly 25%, with US and European prices dropping most as fuel spec changes combined with softer gasoline demand YoY (Exhibit 104). Meanwhile, crude oil prices are roughly 5% higher YoY, which helped compress gasoline cracks. Indeed, front month NYH RBOB-Brent cracks exceeded $30/bbl during the summer months and are now trading at just over $5/bbl. In Europe and Asia, gasoline cracks are even weaker, trading below $5/bbl in the past month (Exhibit 105).

Exhibit 104: Global gasoline prices
Gasoline prices have fallen ~20%, with US and European prices dropping most as fuel spec changes combined with softer gasoline demand YoY



Source: Bloomberg

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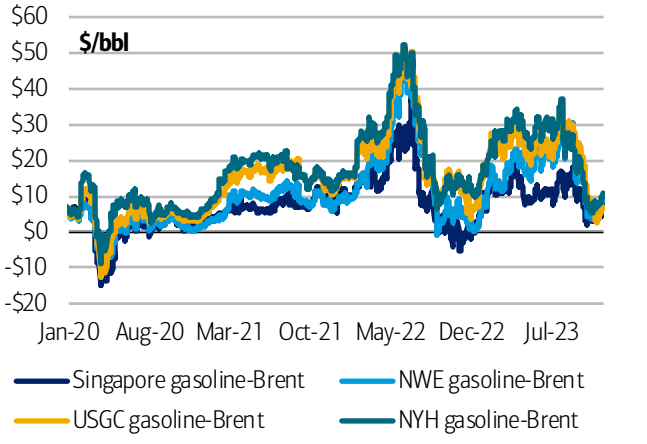
Exhibit 105: Global gasoline cracks
Meanwhile, crude oil prices are roughly 5% higher YoY, which has helped compress gasoline cracks



Source: Bloomberg

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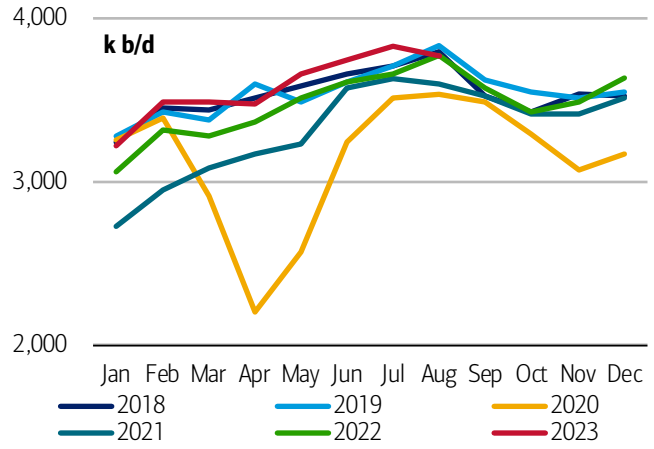
...as demand appears to have softened YoY post driving season...

Gasoline demand had a strong start to the year, with OECD consumption rising 240k b/d YoY through August. In OECD Europe and Asia, consumption rose 140k b/d (Exhibit 106), while North American demand climbed just 100k b/d. US gasoline demand, implied by

weekly DOE data, has turned lower since then, falling below the seasonal lows of the pandemic during September before rebounding slightly to last year's levels (Exhibit 107). Meanwhile, Chinese demand is likely tracking more than 200k b/d above year-ago levels through August according to Woodmac.

Exhibit 106: OECD Europe and Asia gasoline demand
Gasoline demand had a strong start to 2023, with OECD consumption rising 240k b/d YoY through August, with Europe and Asia, accounting for 140k b/d



Source: IEA

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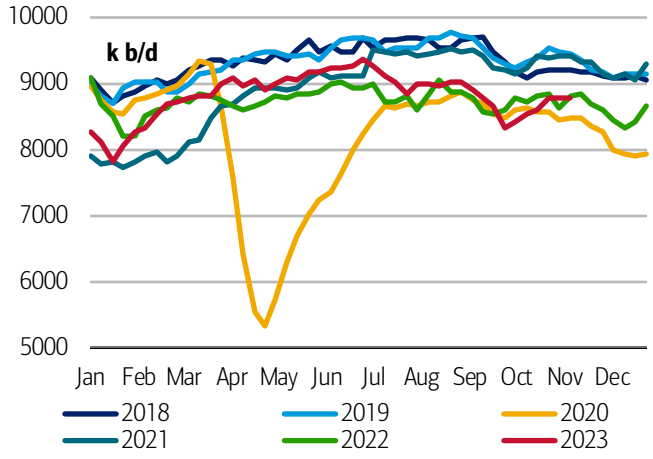
Exhibit 107: US weekly gasoline demand (4 week average)
US gasoline demand, implied by weekly DOE data, has turned lower since then, falling below the seasonal lows of the pandemic during September



Source: Bloomberg

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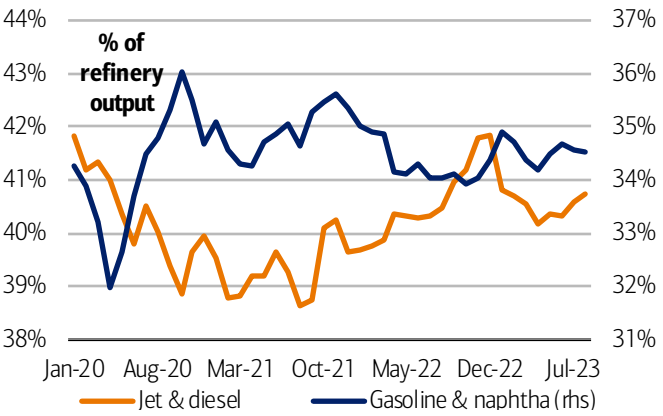
...and refinery gasoline and naphtha yields remain elevated...

Refined product yields have shifted dramatically since the pandemic as refiners attempted to adjust output to meet rapidly changing consumption patterns. The recovery in jet fuel demand helped pull middle distillate yields higher since mid-2021, peaking in late 2022 as refiners responded to historically weak RBOB-ULSD spreads Since then, middle distillate yields have eased, while light distillate yields (naphtha and gasoline) have remained more buoyant (Exhibit 108). Now, RBOB-ULSD spreads have weakened again (Exhibit 109), sending signals to refiners to shift yields towards diesel and jet fuel, but refiners may take time to adjust. Furthermore, the reduction in middle distillate rich OPEC+ supply could limit the ability to raise diesel yields this winter, keeping gasoline and naphtha yields higher than the market desires.

Exhibit 108: Global refinery yields (% of output)
Middle distillate yields peaked in late 2022 and have since eased, while light distillate yields have remained more buoyant



Source: Woodmac

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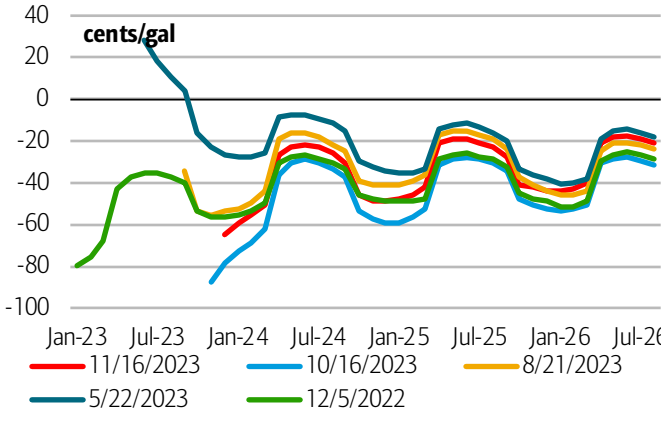
Exhibit 109: RBOB – ULSD spread forward curve
RBOB-ULSD spreads have weakened again, sending a signal to refiners to shift yields towards diesel and jet fuel, but refiners take time to adjust



Source: Bloomberg

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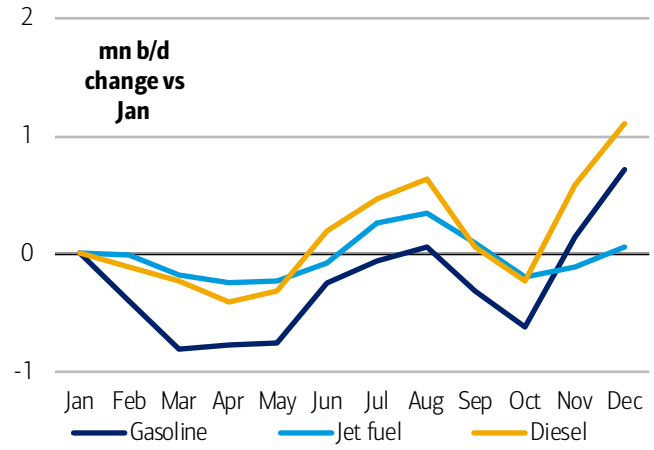
...which helped push inventories toward five-year highs

Historically, gasoline production has risen about 1.3mn b/d between October and December (Exhibit 110), but last year, when RBOB-ULSD spreads were historically weak, gasoline output rose by an estimated 600k b/d over the same period. Persistent high yields and demand weakness helped push gasoline inventories toward seasonal five-year highs since September (Exhibit 111), but incentives have once again swung back toward diesel and jet fuel production. We think RBOB-ULSD weakness should unless there is a clear reversal in either gasoline or middle distillate inventories or it becomes clear that heating oil inventories will be sufficient to survive through winter.

Exhibit 110: Seasonal average profile of global refined product output (2015-19, indexed)

Gasoline output typically rises ~1.3mn b/d from October to December, but historically low RBOB-ULSD spreads led output to rise just 600k b/d in 2022



Source: Woodmac

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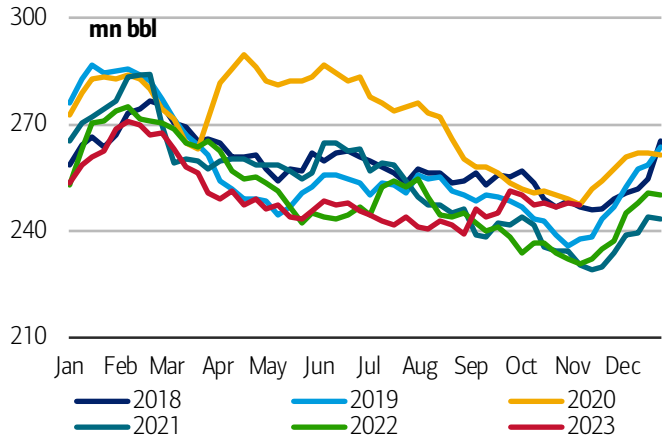
Exhibit 111: Gasoline stocks in the US, ARA, and Singapore

Persistent high yields and demand weakness helped push gasoline inventories toward seasonal five-year highs since September



Source: Bloomberg

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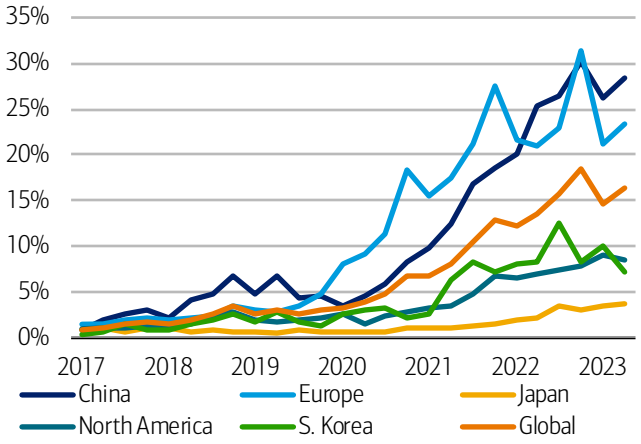
China's re-opening is nearing an end and EVs remain a threat to demand

This year, global gasoline demand received a bump as China's economy re-opened, unleashing a wave of gasoline demand domestically and throughout Asia. The normalization of gasoline demand is nearly complete, and effects of the reopening will be much less pronounced in 2024. Furthermore, global EV sales continue to rise and have reached more than 15% globally in recent quarters (Exhibit 112) and should approach 14 million units this year, according to BNEF (Exhibit 113). In regions like Europe, where the fleet is not growing, high EV penetration rates are likely to weigh on gasoline and diesel demand in the coming years. Even in China, where the fleet is still expanding, potential demand growth is shrinking due to inroads made by EVs.

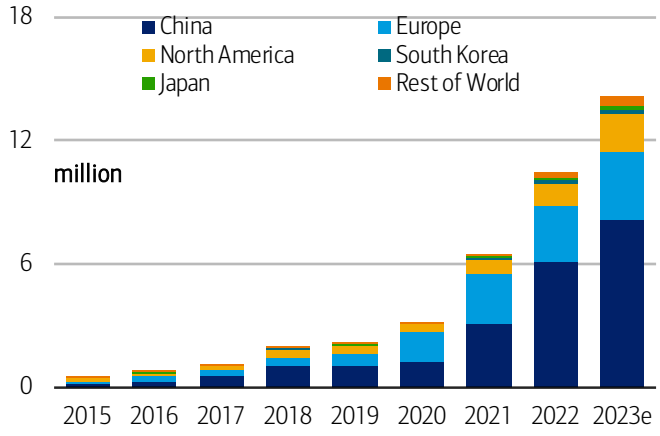
Exhibit 112: EV shares of new passenger vehicles
Global EV sales continue to rise and have reached more than 15% globally in recent quarters



Source: BNEF

BofA GLOBAL RESEARCH

Exhibit 113: Passenger EV sales
High EV penetration rates are likely to mean declining gasoline and diesel demand in the coming years in regions with mature car parcs like Europe



Source: BNEF

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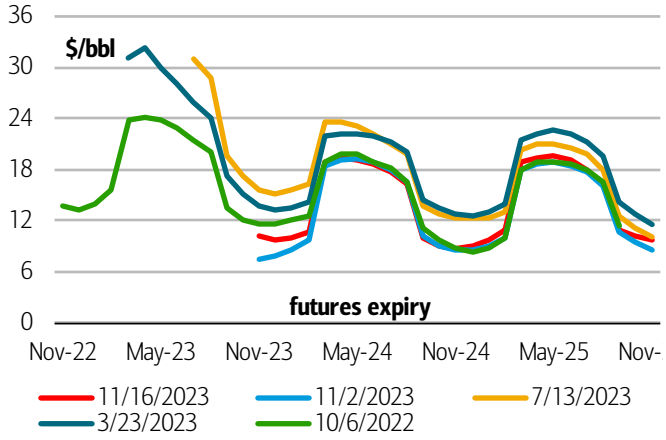
More supply and slowing demand should keep RBOB cracks weak

RBOB-Brent cracks weakened recently (Exhibit 114), driven in part by soft demand, high yields, and collapsing RIN values, but we remain bearish versus the curve (Exhibit 115). We expect gasoline demand growth to slow in 2024 to just 200k b/d YoY and persistent OPEC+ cuts are likely to mean that refiners are forced to process lighter, more gasoline rich barrels. As a result, we think it will be difficult to balance the gasoline market next year, especially during winter months. when gasoline octane constraints are alleviated. We see upside to summer 2024 RBOB-ULSD cracks, but near-term gasoline oversupply may drag those spreads lower first.

Exhibit 114: RBOB-Brent crack forward curve
RBOB-Brent cracks have weakened recently, driven in part by soft demand, high yields, and collapsing RIN values



Source: Bloomberg

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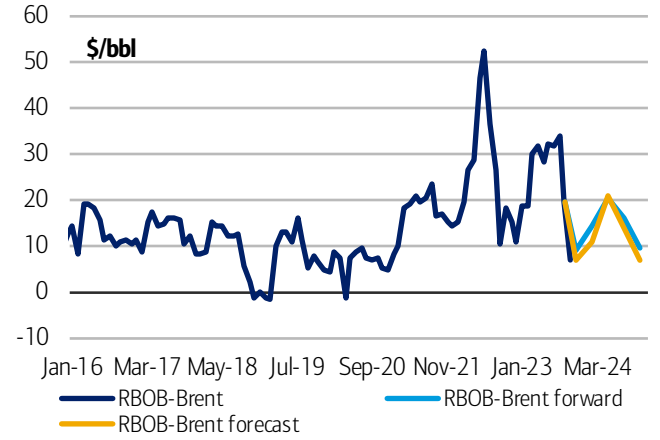
Exhibit 115: RBOB-Brent crack history, forecast, and forward curve
We remain bearish versus the curve for RBOB-Brent but we see upside to summer 2024 RBOB-ULSD cracks



Source: BNEF

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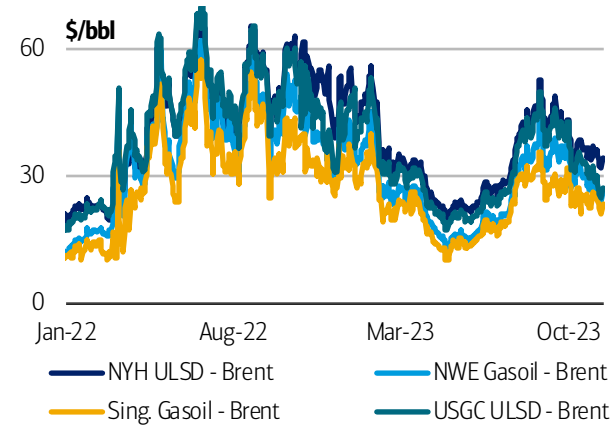
Diesel

After collapsing this spring, diesel cracks soared in 2H23…

Diesel and jet fuel cracks have been linchpins for refining margins in 2H23, but these cracks have weakened recently (Exhibit 116). Since peaking in August around $45/bbl, NWE gasoil – Brent cracks have fallen below $25/bbl, even though gasoil and diesel cracks remain low. Even after their recent selloff, gasoil and diesel cracks remain historically elevated, bested only by last year's performance (Exhibit 117). Excluding

2022, NWE gasoil-Brent cracks are roughly $9/bbl above the highest seasonal level over the past 5 years.

Exhibit 116: Regional diesel and gasoil cracks
Diesel and jet fuel cracks have been the linchpins for refining margins in 2H23, but these cracks have weakened recently



Source: Bloomberg

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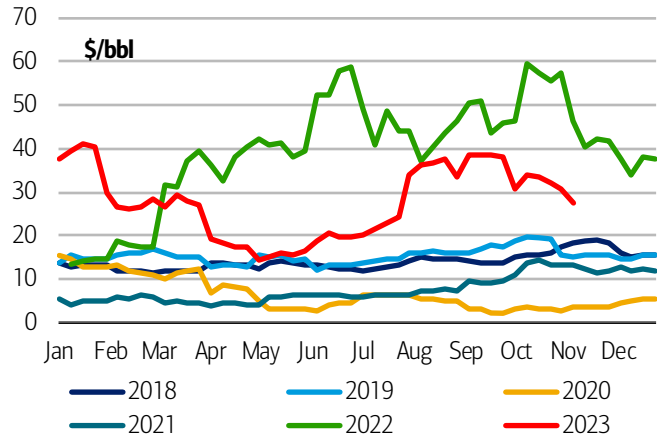
Exhibit 117: NWE gasoil-Brent crack
Even after rolling over, gasoil and diesel cracks remain historically elevated, bested only by last year's performance



Source: Bloomberg

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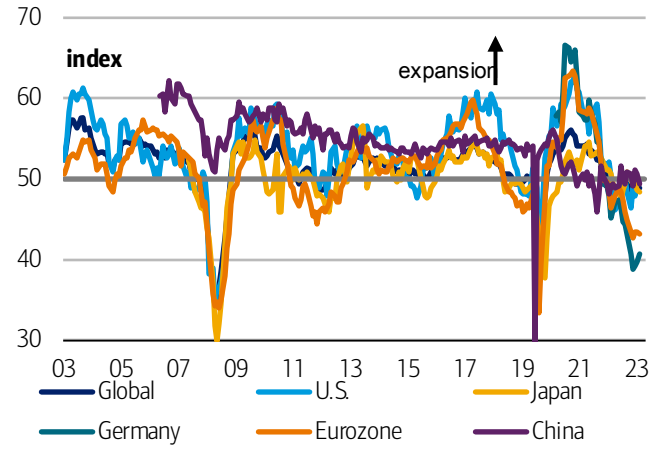
...but this has more to do with the jet fuel demand recovery...

Diesel and gasoil are viewed as fuels for industry and freight in most of the world, save for countries like India and France, where diesel is used often as a passenger vehicle fuel. As a result, gasoil and diesel demand are driven primarily by industrial and freight activity, which has not been particularly healthy this year. Manufacturing PMIs dipped negative in many countries over the past year (Exhibit 118), with activity softening most notably in Europe, where high energy costs have made industry less competitive. Additionally, trade out of most Asian countries has contracted recently (Exhibit 119) as demand for goods from the West slowed.

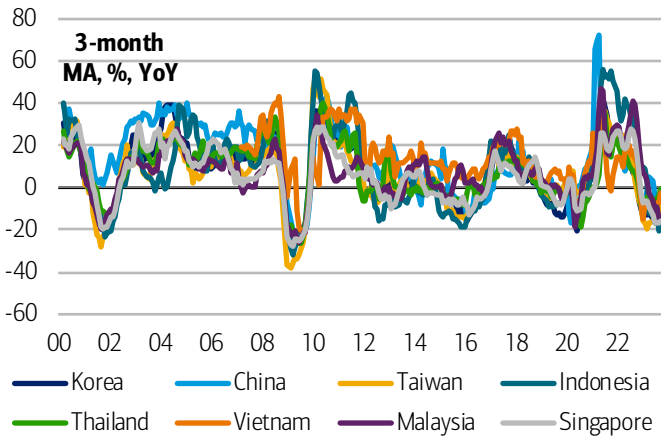
Exhibit 118: Manufacturing PMIs
Manufacturing PMIs dipped negative in many countries over the past year, with activity softening most notably in Europe



Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 119: Exports by country
Additionally, exports from many Asian countries declined this year as demand for goods from the West slowed



Source: Bloomberg

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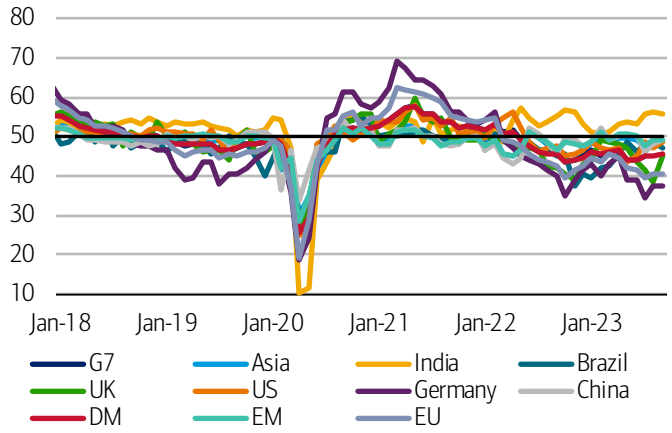
...because diesel demand has been softer than most other fuels

Demand for diesel has been soft this year, and there are no clear signs yet that consumption is reaccelerating. New export orders are contracting across many countries, though India appears to be benefiting from friend-shoring dynamics (Exhibit 120). Although new export orders are still declining, activity could bottom and start to rebound

in the coming quarters since inventory-to-sales ratios in countries like the US have stopped rising and now appear to be tightening across different areas of the supply chain. Weak diesel demand growth during 2023 has done little to help rebuild middle distillate inventories, leaving diesel cracks vulnerable to explosive upside moves as winter approaches (Exhibit 121). This is especially true on the US East Coast and NWE, where refiners are unable to produce enough middle distillate to meet regional demand.

Exhibit 120: New export orders (manufacturing PMI)
New export orders remain in contraction globally, save for a few countries like India that are benefiting from friend-shoring dynamics



Source: Bloomberg

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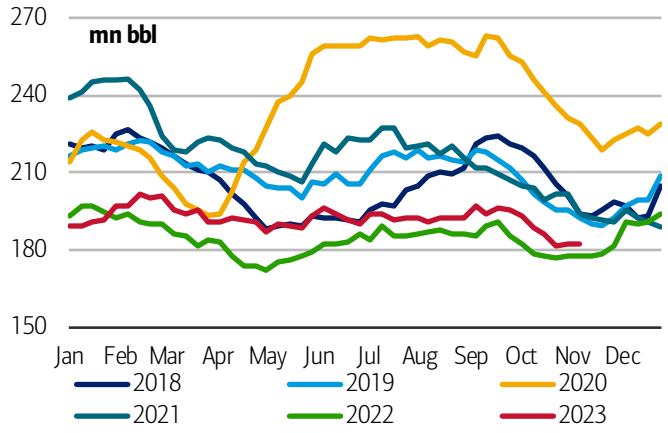
Exhibit 121: Middle distillate inventories in the US, ARA, and Singapore
Weak demand growth has done little to help rebuild middle distillate stocks, leaving diesel cracks vulnerable to explosive upside moves as winter nears



Source: Bloomberg

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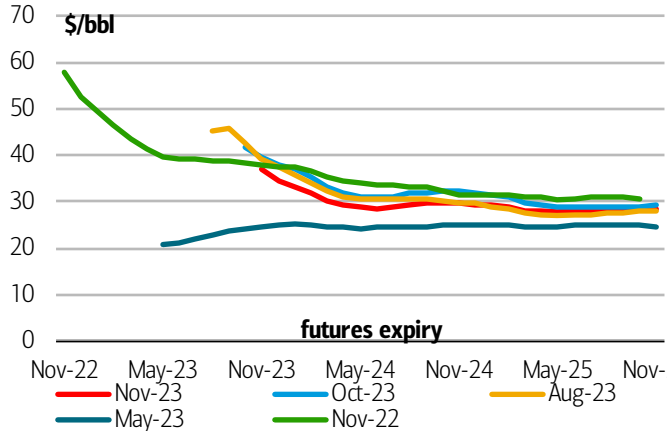
Winter cracks may stay resilient, but we are bearish vs the curve in '24

Rising jet fuel demand, low inventories, elevated fall refinery maintenance, and stockpiling efforts in some countries should keep diesel cracks buoyant this winter, with risk of explosive upside in the event of cold weather (Exhibit 122). We see room for diesel cracks to outperform the forward curve into winter, but we see downside risk to cracks next year on new refining capacity, and rising exports of heavy crude from Canada and Venezuela (Exhibit 123). However, diesel cracks face upside risk if Middle East medium and heavy sour crude oil production declines due to disruptions or stricter sanctions enforcement.

Exhibit 122: NYH ULSD – Brent crack forward curve

Rising jet demand, low inventories, elevated refinery maintenance, and stockpiling should keep diesel cracks buoyant this winter



Source: Bloomberg

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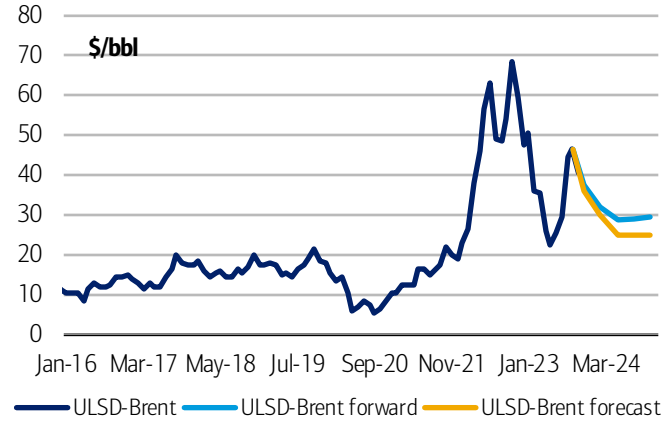
Exhibit 123: NYH ULSD – Brent crack history, forecast, and forward curve
Diesel cracks could outperform near term depending on weather, but we see downside for cracks in 2024 on new refining capacity



Source: Bloomberg, BofA Global Research estimates

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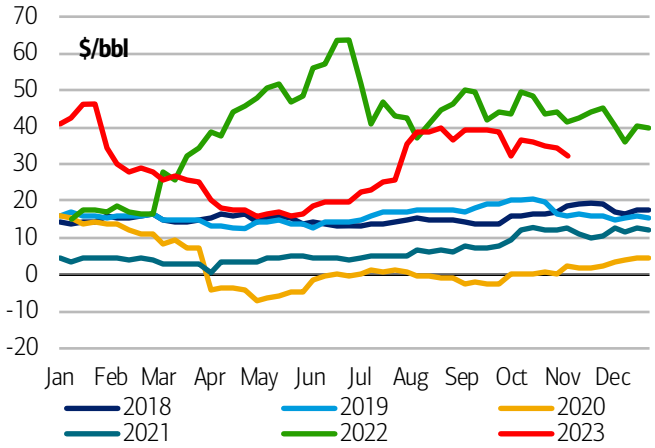
Jet fuel

Jet fuel cracks have been supported by a steady rebound in air travel…

Global air travel kept jet fuel cracks elevated for most the last 18 months (Exhibit 124), with cracks trading up toward $70/bbl in June of 2022 before easing into year-end. Cracks continued to decline into 2023, bottoming out in May at about $14/bbl. Since then, jet fuel cracks rallied, exceeding $40/bbl briefly during 3Q. Jet fuel's strong performance has been driven by a steady recovery in demand, which helped keep growth on track to exceed 900k b/d this year (Exhibit 125). Incremental supply for the jet fuel market has been challenging, requiring refiners to pull jet fuel out of the diesel pool, a reversal of the trend that occurred during 2020, when air travel was near zero.

Exhibit 124: NWE jet fuel – Brent cracks
Global air travel has kept jet fuel cracks elevated for most the last 18 months…



Source: Bloomberg

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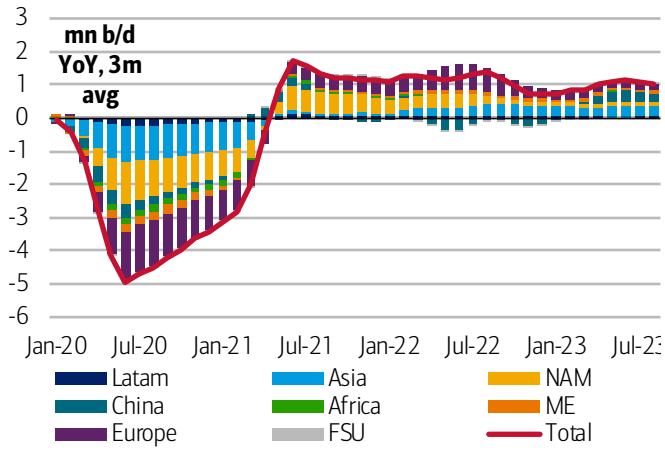
Exhibit 125: Jet fuel demand growth
…as global jet fuel demand growth has trended above 900k b/d this year



Source: Woodmac

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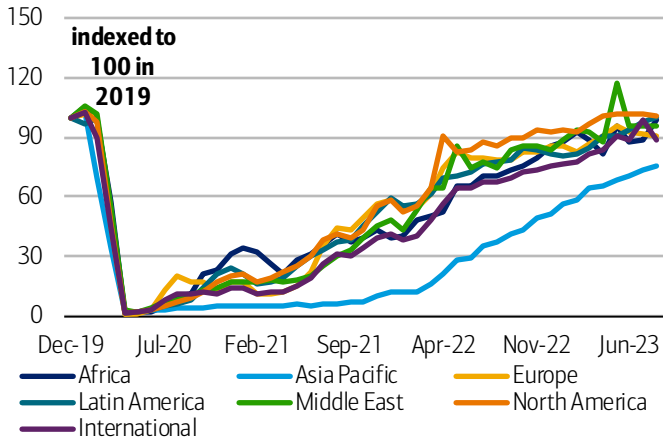
…and there is room for international air travel to recover further…

Domestic air travel drove the initial stage of the jet fuel demand recovery, with international air travel lagging (Exhibit 126). International flights originating from some regions have normalized by now, but flights out of Asia have been a noticeable laggard due to China's reluctance to dispose of its zero-Covid policy until late 2022. Asian air travel accelerated in 2022 but flights remain below seasonal pre-Covid levels. Even so, aggregate jet fuel demand has recovered healthily, nearly topping 7mn b/d during the height of summer travel (Exhibit 127). New flights out of Asia created a noteworthy jump in Asian jet fuel demand since October and expectations are for further normalization in November as more trans-Pacific flights return to service.

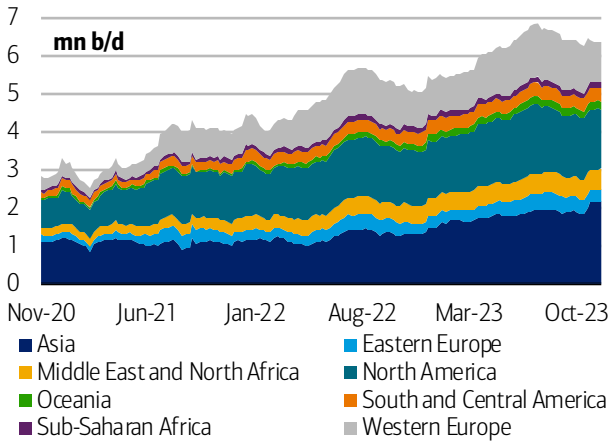
Exhibit 126: International RPK: Actual passenger traffic growth
Domestic air travel drove the initial stage of the jet fuel demand recovery, with international air travel lagging



Source: IATA, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 127: Estimated jet fuel demand by region of flight origin
Aggregate jet fuel demand has recovered healthily, nearly topping 7mn b/d during the height of summer travel



Source: BNEF

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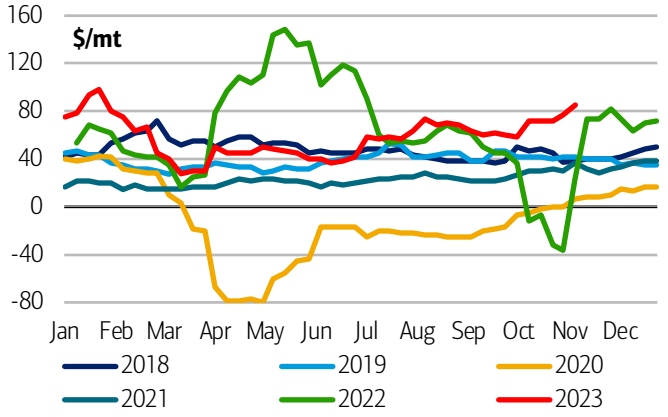
...which should keep middle distillates tight and cracks relatively elevated

The recovery in jet fuel demand and challenges emanating from the refining sector due to feedstock adjustments and unplanned outages propped up jet fuel cracks since 2022. While diesel demand growth has stalled recently, jet fuel demand growth has continued apace, helping support higher jet regrades to encourage maximum jet fuel yields (Exhibit 128). Absent a recession or a material change in the global oil supply mix that boosts middle distillate rich crude oil supply, jet fuel cracks should remain elevated near term (Exhibit 129). In fact, we see upside risk for jet fuel cracks into winter, but we remain bearish versus the curve on average in 2024 on expectations for more refining capacity and growth in heavier crude oil supply, especially out of Canada and Venezuela.

Exhibit 128: NWE jet regrade (jet fuel – gasoil spread)
Diesel also competes with jet fuel for yield, and jet regrades suggest refiners should prioritize maximizing jet fuel yields over diesel



Source: Bloomberg

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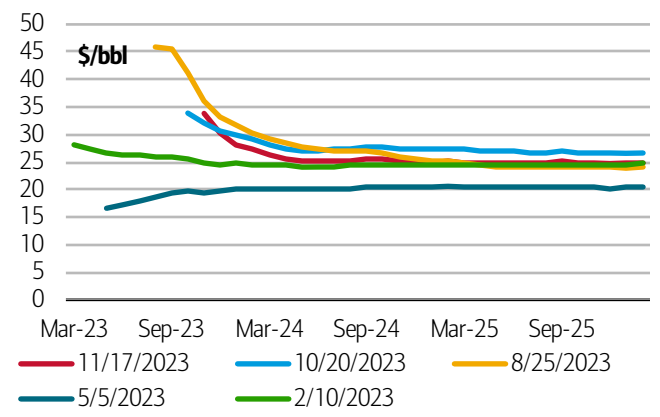
Exhibit 129: NWE jet fuel – Brent crack forward curve
Low middle distillate inventories and still normalizing jet fuel demand should support jet fuel cracks near term



Source: Bloomberg

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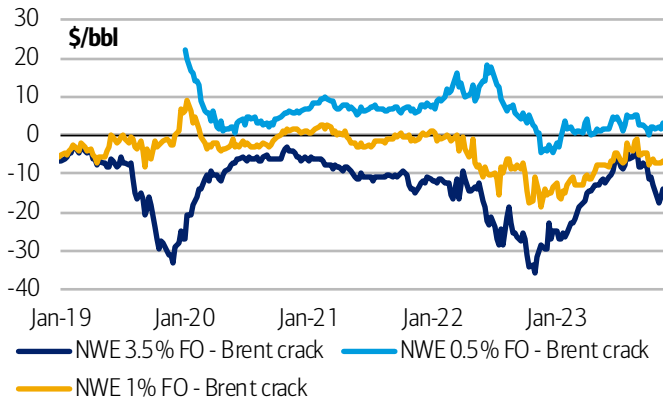
Residual fuel oil

Fuel oil cracks have eased, and sulfur spreads widened post summer

As crude oil and refined product prices turned lower in 2H22, the fuel oil complex was hit particularly hard. HSFO, LSFO, and VLSFO, which crashed 26%, 24%, and 34% during July-December (Exhibit 130), were dragged lower by a confluence of factors, including rising OPEC+ medium and heavy sour production, collapsing consumer demand for goods (falling global trade), and rising refinery runs (more supply). At the

lows, NWE HSFO-Brent cracks were trading around -$37/bbl, creating a huge drag on simple refinery margins, but this often-shunned fuel saw reversal of fortunes this summer. By the end of July, NWE HSFO-Brent cracks rallied more than $30/bbl and were trading above -$5/bbl, while NWE VLSFO-Brent cracks, which bottomed around -$6/bbl in November 2022, had increased to just +$5/bbl. Sulfur spreads also reached historically low levels, disincentivizing the production of VLSFO during the summer months (Exhibit 131). Since then, Middle East summer fuel oil burns have subsided and Canadian supply has returned, along with more Iranian and Venezuelan barrels too, weighing on fuel oil cracks once more.

Exhibit 130: NWE fuel oil cracks
Fuel oil cracks peaked in July and August and have steadily weakened since then on more Iranian, Venezuelan, and Canadian supply among other factors



Source: Bloomberg

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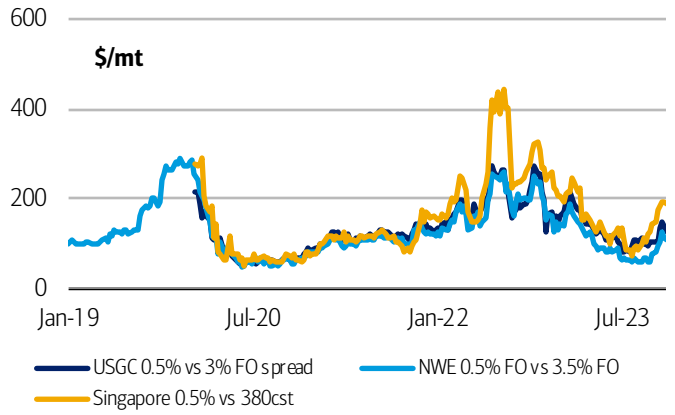
Exhibit 131: Low sulfur – high sulfur fuel oil spreads
Sulfur spreads also reached historically low levels in July and August and have since started to rebound



Source: Bloomberg

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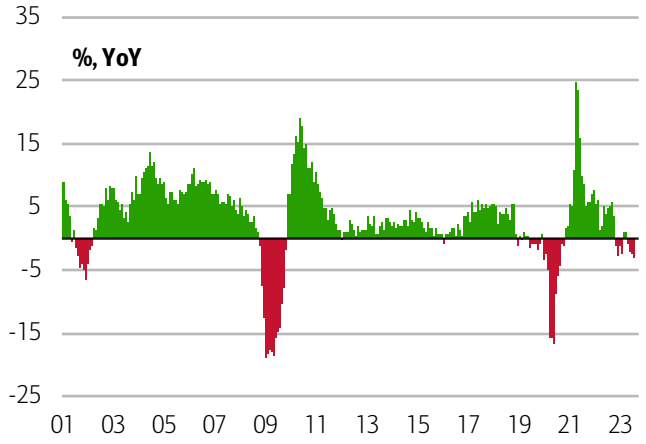
Although we think global trade is likely to remain soft into 2024...

Global trade activity has swung wildly since the start of the pandemic, first contracting by more than 15% YoY during the height of lockdowns in 2020, then rising by 25% YoY briefly in 2021 as activity rebounded, fueled by stimulus spending. Then in late 2022, global trade began to contract again as demand for goods faded, and trade has now contracted in nine of the past ten months (Exhibit 132). Global trade growth plays a role in determining growth in fuel oil demand (Exhibit 133), along with fleet fuel efficiency, fuel costs (which influence ship speeds/fuel usage), and other factors like fuel use in the power sector, which likely increased last year as high natural gas and coal prices made fuel oil more economic. Expectations for slower economic growth and the prospect of recession present downside risk for fuel oil demand and could influence fuel oil cracks too.

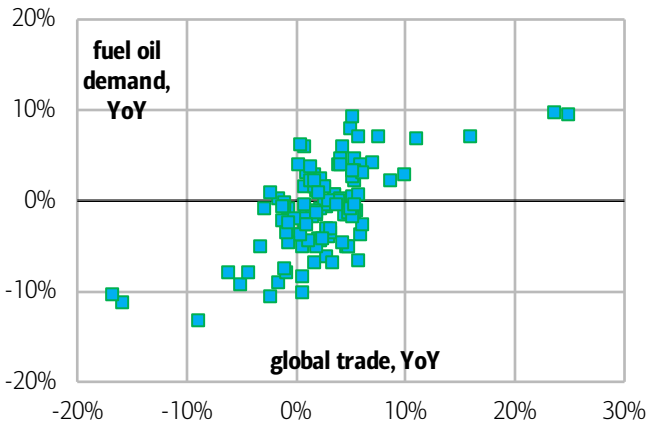
Exhibit 132: Global Trade Growth
Global trade began to contract in late 2022 as demand for goods faded and has shrunk YoY in nine of the past ten months



Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 133: Global fuel oil demand and global trade
Expectations for slower GDP growth and the prospect of recession present downside risk for fuel oil demand and could influence fuel oil cracks too.



Source: Bloomberg, Woodmackenzie

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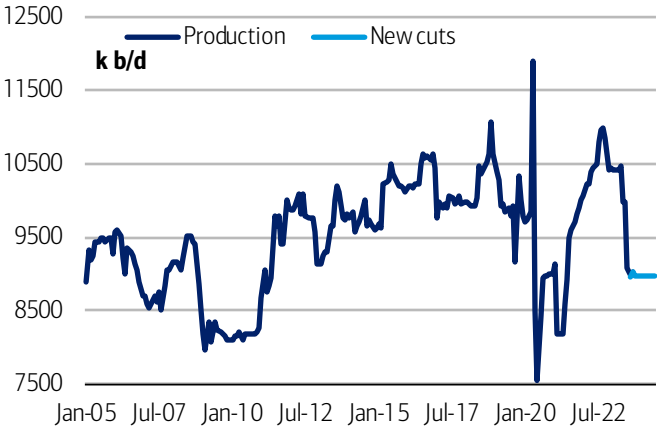
...fuel oil markets are likely to be driven by the supply side...

In addition to demand side dynamics like upgrading margins, global seaborne trade, and seasonal swings in power sector demand, the fuel oil market is also driven by supply side dynamics like availability of heavier crude oils. OPEC+'s decision to cut output multiple times since late 2022 effectively reduced the market's ability to produce fuel oil. Saudi Arabia's decision to keep supply offline until the end of the end of the year at the least should keep pressure on fuel oil supply (Exhibit 134). Middle East crude oil exports have shrunk because of these decisions (Exhibit 135).

Exhibit 134: Saudi Arabia crude oil production
Saudi Arabia's decision to keep supply offline until the end of the year should keep pressure on fuel oil supply



Source: Bloomberg, IEA, BofA Global Research

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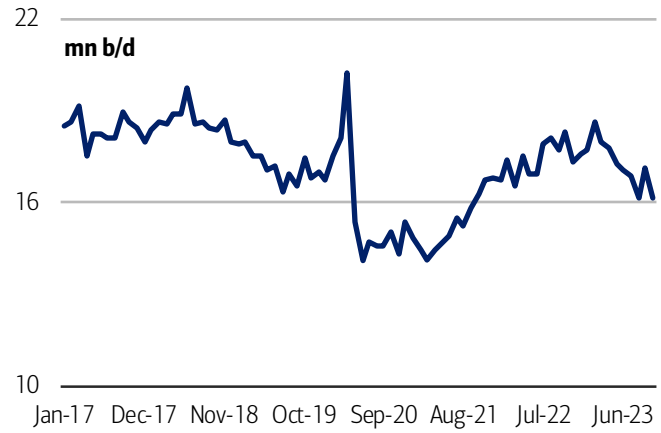
Exhibit 135: Middle East waterborne crude oil exports by country
Middle East crude oil exports have shrunk because of these decisions, though Iranian supply has partially offset cuts elsewhere



Source: Bloomberg

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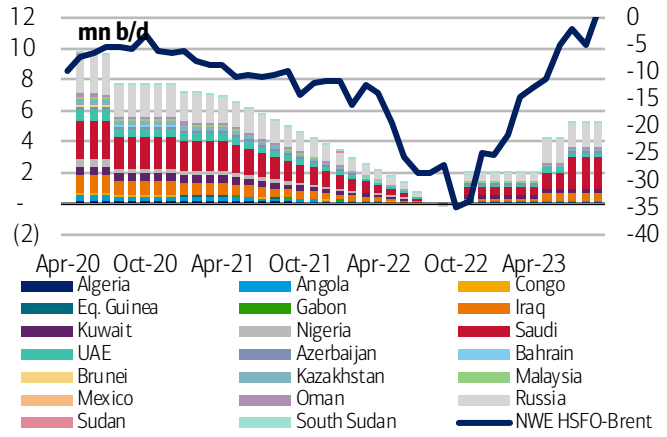
...where OPEC+ cuts persist, and Iranian supply may tighten again...

HSFO-Brent cracks have clearly strengthened since late 2022 when OPEC+ supply peaked (Exhibit 136), reaching a high over the summer as power burns, Canadian oil sands maintenance, and a step up in Saudi cuts. Fuel oil cracks have since eased since alongside gasoline cracks, pushing down margins for simpler refiners (Exhibit 137). Yet, we see risk of Middle East conflict causing further disruptions to medium and heavy sour supply in the region. Supply curbs could come in the form of increased sanctions enforcement efforts against Iran or from physical disruptions in the region.

Exhibit 136: OPEC+ production cuts and HSFO-Brent cracks
Changes in OPEC+ supply, especially from GCC countries, have influenced HSFO-Brent cracks



Source: OPEC, Bloomberg, BofA Global Research estimates

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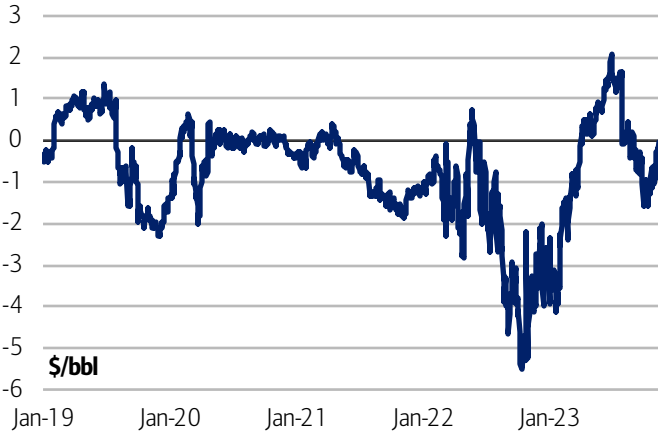
Exhibit 137: WTI FCC vs coking margins
Looser fuel oil balances have coincided with rising gasoline inventories and have contributed to weaker margins for simpler refiners



Source: Bloomberg

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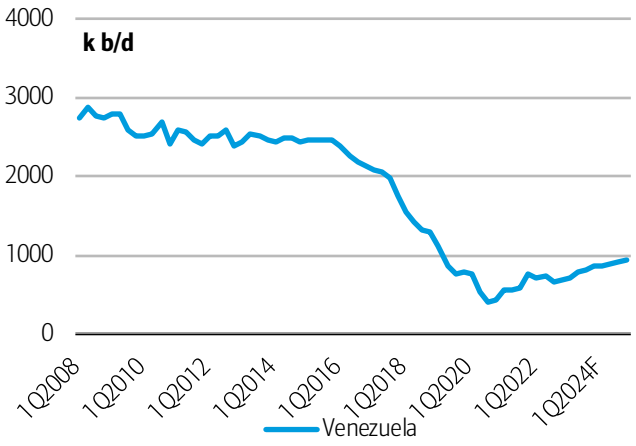
...while Canadian and Venezuelan supplies should rise into 2024

Venezuela recently received sanctions relief for a six-month period, with the prospect for more permanent relief if upcoming elections are deemed fair. The country has been ramping output over the past two years owing in part to rising output at Chevron's Petropiar project (Exhibit 138). While we don't expect a significant change in output with the granting of temporary sanctions relief, we do expect output will continue to rise into the future, with production growing 125k b/d YoY in 2024. In Canada, we anticipate supply growth of roughly 200k b/d YoY in 2024 in response to higher prices and the startup of the Transmountain Expansion pipeline (Exhibit 139). Most of the growth from these two countries will likely be medium and heavy crude oil, which adds to potential fuel oil supply.

Exhibit 138: Venezuela crude oil production
While we don't expect a significant change in Venezuelan output near term, we do expect output will rise 125k b/d YoY in 2024



Source: IEA, BofA Global Research estimates

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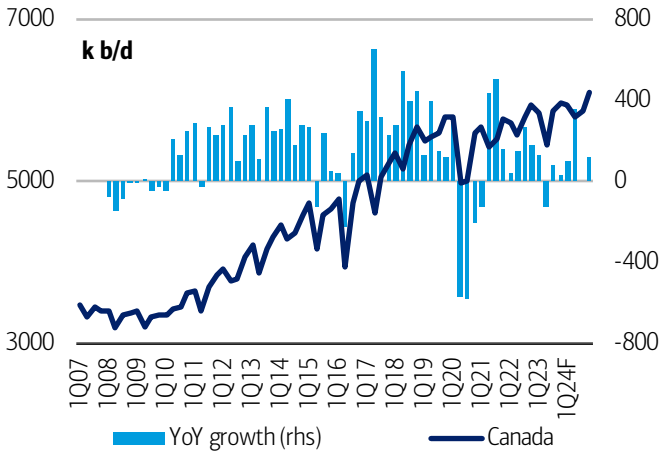
Exhibit 139: Canada oil production
In Canada, we anticipate supply growth of roughly 200k b/d YoY in 2024, helped by high oil prices and improved pipeline takeaway capacity



Source: IEA, BofA Global Research estimates

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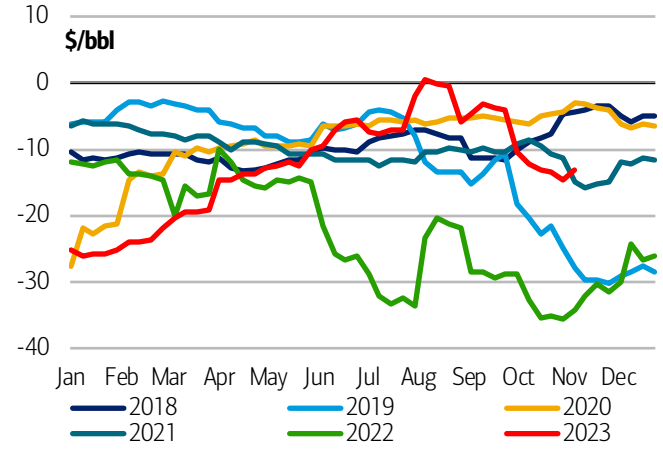
Tight sour crude supply, rising complex capacity to support HSFO cracks...

HSFO-Brent cracks reached their highest level in many years during the summer of 2023 (Exhibit 140), but fundamentals have loosened since then, causing cracks to ease. We see room for HSFO cracks to tighten again into mid-2024 (Exhibit 141), especially if OPEC+ cuts persist and Iranian supply is curbed by more strict sanctions enforcement. HSFO could also benefit from refinery run cuts if the current downward trend in gasoline

and diesel cracks persist. NWE HSFO-Brent cracks could see upside next summer on oil sands maintenance, the start-up of the TMX pipeline and the seasonal uptick in power sector fuel oil demand.

Exhibit 140: NWE HSFO – Brent crack

HSFO-Brent cracks reached their highest level in many years during the summer of 2023, but fundamentals have loosened since then



Source: Bloomberg

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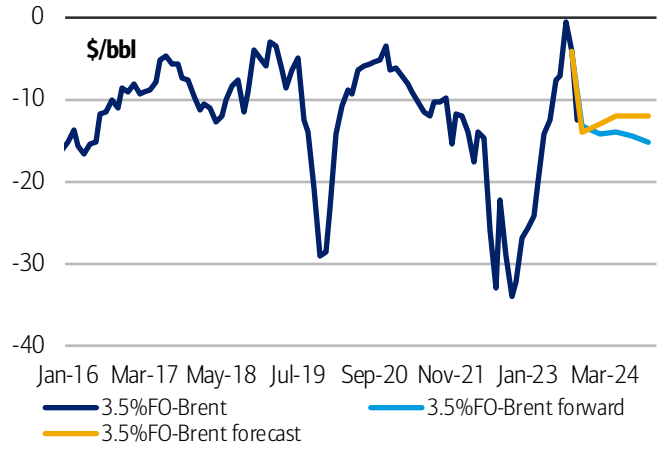
Exhibit 141: NWE HSFO – Brent crack history, forecast, and forward curve

We see room for HSFO cracks to tighten into mid-2024, especially if OPEC+ cuts persist and Iranian supply is curbed by stricter sanctions enforcement



Source: Bloomberg, BofA Global Research estimates

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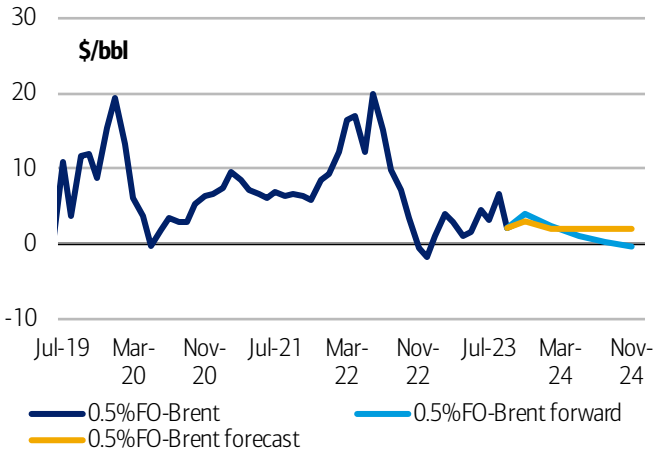
...while VLSFO cracks should remain pressured by new supply

As global refining capacity continues to ramp up, we expect more VLSFO supply to hit the market, posing downside risk to VLSFO cracks (Exhibit 142). However, the forward curve for VLSFO is cheap relative to history and likely has little downside from here due to the relative value of VLSFO versus sweet crudes. VLSFO-HSFO spreads have widened after troughing mid-year. Summer VLSFO-HSFO weakness was driven by OPEC+ cuts, rising complex refining capacity, and falling natural gas prices. From here, we see room for HSFO to appreciate versus VLSFO and think there is downside risk to the 0.5%-3.5% fuel oil spread (Exhibit 143). Fundamentals have weakened post summer cooling season in the Middle East and due to rising Iranian supply, but we expect OPEC+ cuts to persist into 2024 and expect rising complex capacity will only increase demand for sour crudes and residual fuel. Risks to this view include a rebound in OPEC or other medium/heavy sour supply, rising global gas prices, or faltering Chinese demand, which could push 0.5%-3.5% spreads wider and HSFO-Brent down further from here.

Exhibit 142: NWE VLSFO – Brent crack history, forecast, and forward curve

While we expect new supply to pressure VLSFO cracks, we see limited downside from here due to VLSFO's value relative to sweet crudes



Source: Bloomberg, BofA Global Research estimates

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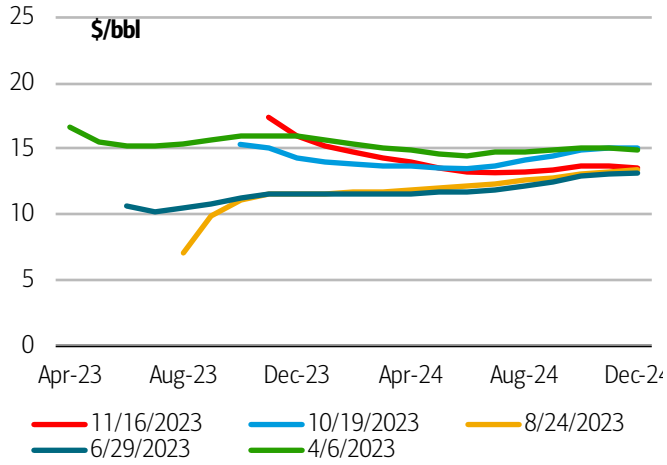
Exhibit 143: 0.5% FO – 3.5% FO spread implied forward curve

We see room for HSFO to appreciate versus VLSFO and think there is downside risk to the 0.5%-3.5% fuel oil spread



Source: Bloomberg, BofA Global Research

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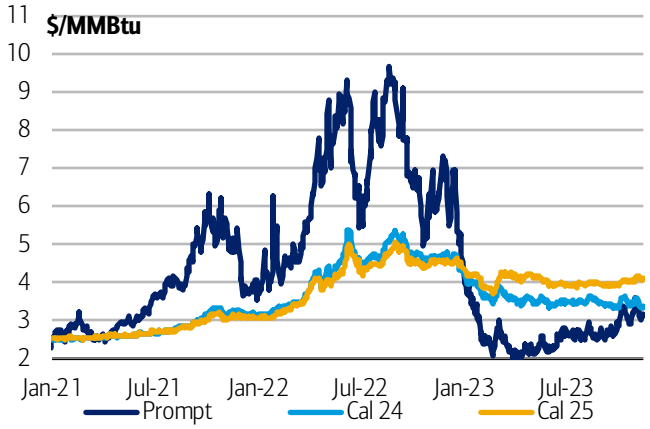
2.3 US natural gas

Henry Hub nat gas slowly climbed higher in 2023…

After collapsing from a decade high of $10/mmbtu in 2022 to less than $2/mmbtu in February this year, Henry Hub natural gas prices have been slow to recover, with front month prices only closing above $3/mmbtu on a consistent basis in October (Exhibit 144). Although inventories built at a slower than average pace in recent months, natural gas prices have failed to move meaningfully higher, partly because inventories were still historically high. As prices calmed down, realized volatility has come down steadily, while implied volatility has remained elevated (Exhibit 145).

Exhibit 144: Henry Hub natural gas prices
Henry Hub prices have slowly ground higher and only started closing above $3/mmbtu on a regular basis in October.



Source: Bloomberg, BofA Global Research

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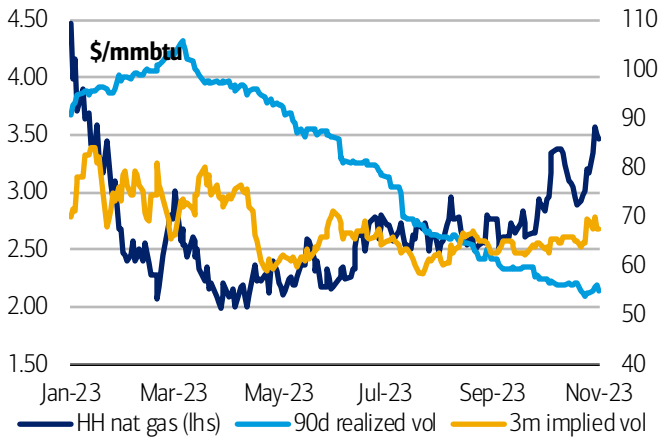
Exhibit 145: Henry Hub natural gas prices and realized and implied volatility
As prices calmed down, realized volatility has come down steadily, while implied volatility has remained elevated



Source: Bloomberg, BofA Global Research

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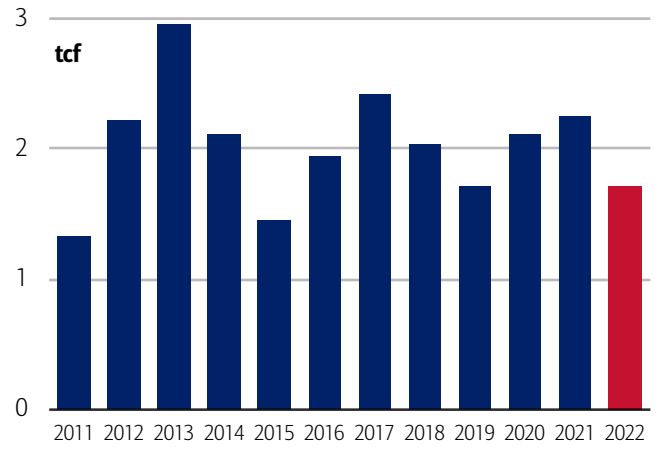
…as lofty end of winter storage created a headwind for prices

The evolution of US natural gas inventories over the winter period depends heavily on weather. During a cold winter, like the notorious Polar Vortex of 2013/14, when natural gas demand averaged 7.3Bcf/d higher YoY (Nov-Mar) and production rose just 1.9Bcf/d, inventories drew down nearly 3Tcf. Two years later, a mild winter in 2015/16 that caused demand to fall 5.6Bcf/d YoY, coupled with nearly stagnant gas production (+490mmcf/d YoY), pulled just 1.5Tcf of gas out of inventories (net) over the winter period (Exhibit 146). The mild winter of 2022 drew 1.7Tcf of gas from storage, lifting inventories from the five-year average levels at the start of winter toward five-year high levels in March (Exhibit 147). This swelling of storage helped precipitate the collapse in US natural gas prices.

Exhibit 146: US natural gas inventory withdrawals (end Oct to end Mar)
The evolution of US gas inventories over winter depends heavily on weather, and mild temperatures last winter led to just 1.7Tcf of inventory draws...



Source: EIA , BofA Global Research

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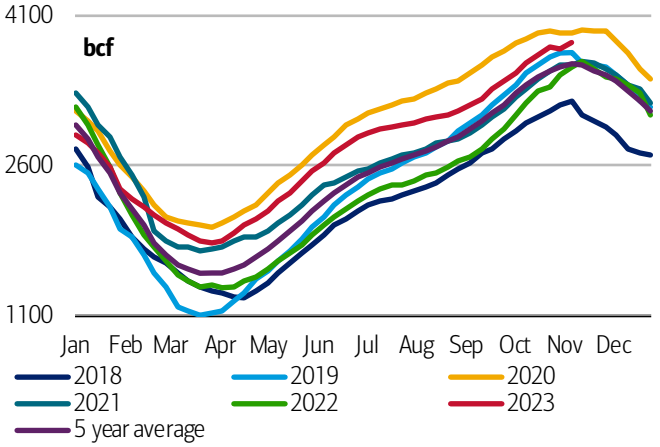
Exhibit 147: US natural gas working inventories
...which lifted inventories from the five-year average levels at the start of winter toward five-year high levels in March



Source: Bloomberg, BofA Global Research

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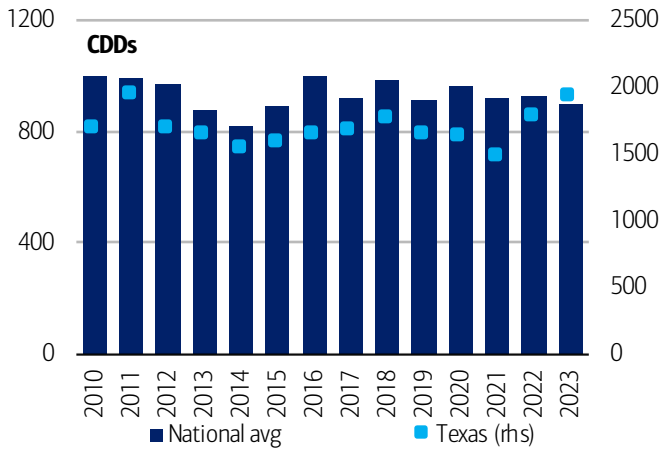
But warm summer weather boosted power demand...

Weather has been kind to the natural gas market this summer after a very mild winter, that led to below normal residential, commercial, and industrial demand. Cooling Degree Days (CDDs) across the US don't look particularly high year-to-date (Exhibit 148), but summer has been very hot in the South. Texas has experienced significantly warmer than normal weather and the most CDDs since 2011. This heat has contributed to new record power demand and generation during July and August (Exhibit 149). Persistent warm weather could bring record generation in September too.

Exhibit 148: Cumulative CDDs during Jun-Aug
Cooling Degree Days across the US don't look particularly high year-to-date, but summer has been very hot in the South



Source: Bloomberg, BofA Global Research

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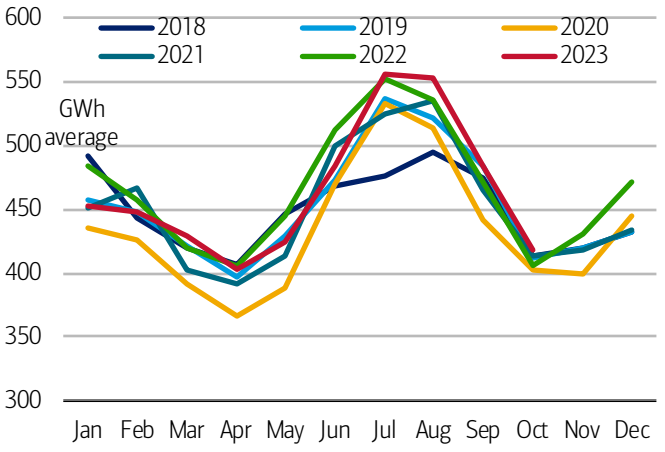
Exhibit 149: L-48 power generation
...and contributed to above record power demand and thus generation in July and August



Source: Bloomberg, BofA Global Research

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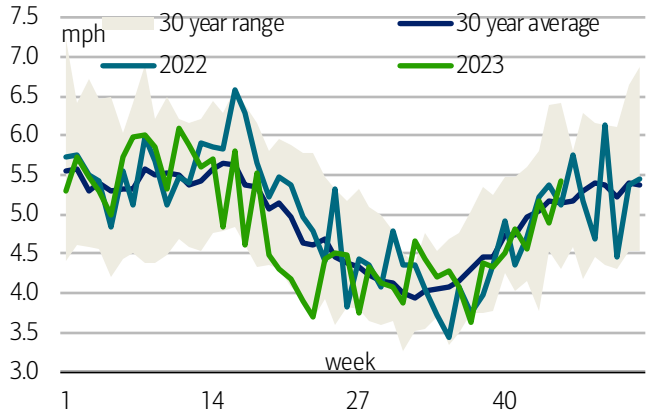
...and wind performed exceptionally poorly this year...

While net power generation has been trending higher during the summer, wind has not contributed to this growth. In fact, the heat dome over Texas likely contributed to some of the lowest wind speeds in at least 30 years during 2Q23 (Exhibit 150). Wind generation has come in significantly below year ago levels during 2Q (Exhibit 151), which is impressive considering growth in capacity throughout 2022-23. Solar has performed much better due to low cloud cover this summer, but relatively smaller

installed capacity has meant that it has not offset lower wind output, placing more of a burden on thermal generation.

Exhibit 150: National weekly wind speeds
The heat dome over Texas likely contributed to some of the lowest wind speeds in at least 30 years during 2Q23



Source: CWG

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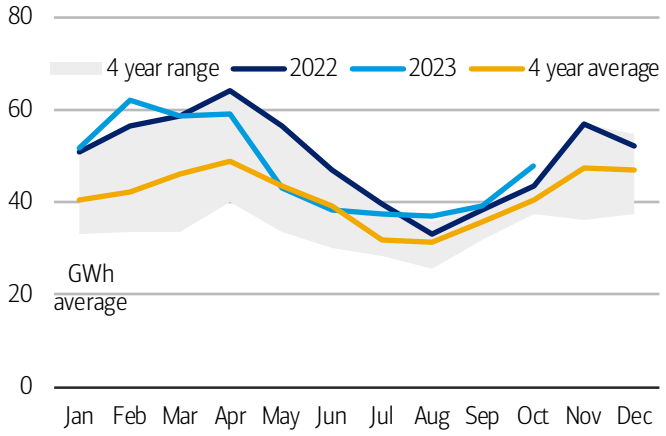
Exhibit 151: US L-48 net generation from wind
Wind generation came in significantly below year ago levels during 2Q, which is impressive considering capacity growth during 2022-23



Source: Bloomberg, BofA Global Research

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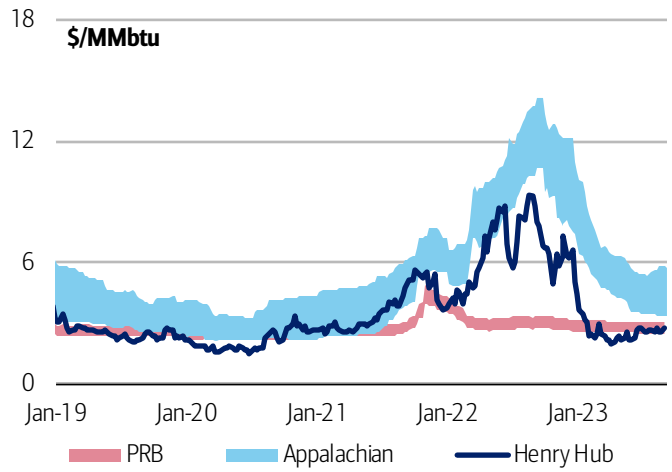
...while coal has largely been uncompetitive vs gas...

The collapse in natural gas prices outpaced coal, leaving most Northeast coal generation out of the money (Exhibit 152). Gas even fell below the Rockies coal switching levels during the first half of the year. Coal's lack of competitiveness, along with coal plant retirements led to coal generation falling to 2020 levels for most of 2023, while the grid's call on thermal generation fell to a lesser degree (Exhibit 153). More recently, coal generation has started to pick up again, but time will tell whether this strength will persist.

Exhibit 152: US coal to gas switching bands
The collapse in natural gas prices outpaced coal, challenging most Northeast coal generation



Source: Bloomberg, Platts, EIA, BofA Global Research estimates

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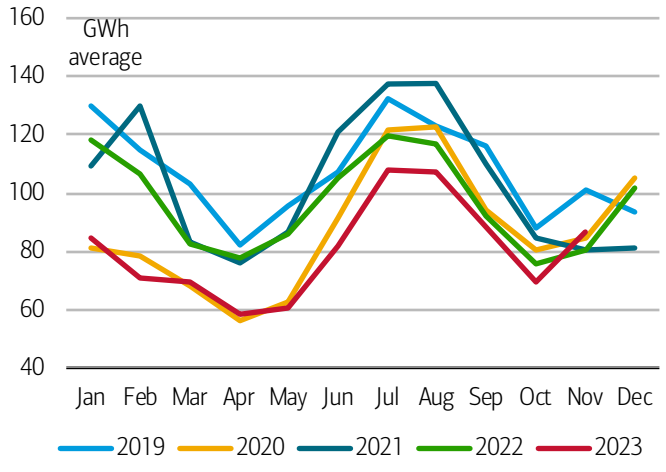
Exhibit 153: L-48 net coal power generation
Coal's lack of competitiveness, along with coal plant retirements led to coal generation falling to 2020 levels for most of 2023



Source: Bloomberg, BofA Global Research

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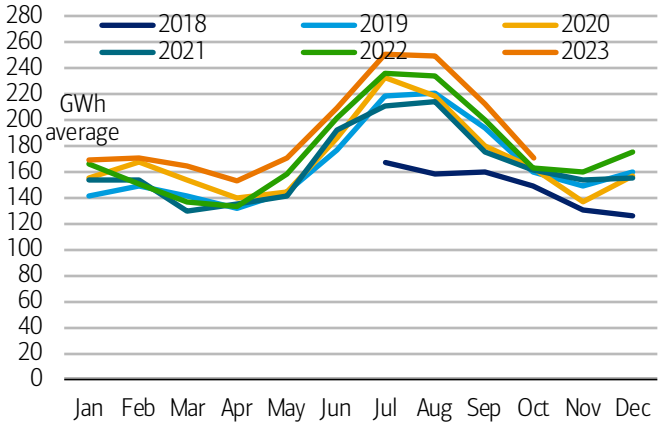
These factors drove another year of record gas power burns...

Soaring power demand, uncompetitive coal generation, and record low wind speeds during the spring have all contributed to exceptional natural gas power generation this year. In fact, gas generation has averaged roughly 191GWh so far this year, an increase of 16GWh YoY (Exhibit 154). March generation reached 27GWh higher YoY partially due

to the weakness in renewables. With higher generation typically comes higher gas power burns. Natural gas use in the power sector is estimated to have risen 560Bcf YoY during January-August (Exhibit 155) following an increase of 570Bcf YoY over the same period in 2022 as exceptional summer heat stressed the grid.

Exhibit 154: Monthly gas generation in Lower 48
Natural gas power generation has averaged roughly 191GWh so far this year, an increase of 16GWh YoY



Source: Bloomberg, BofA Global Research

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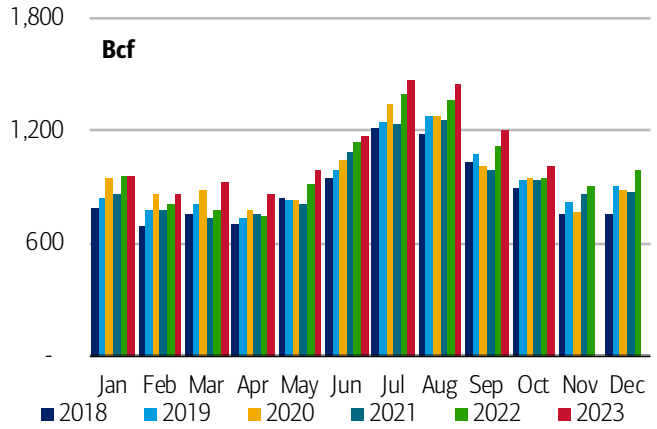
Exhibit 155: Estimated US natural gas power burns by month
Gas use in the power sector rose 731Bcf YoY through October following a nearly identical increase YoY in 2022 as exceptional summer heat stressed the grid



Source: Bloomberg, BofA Global Research

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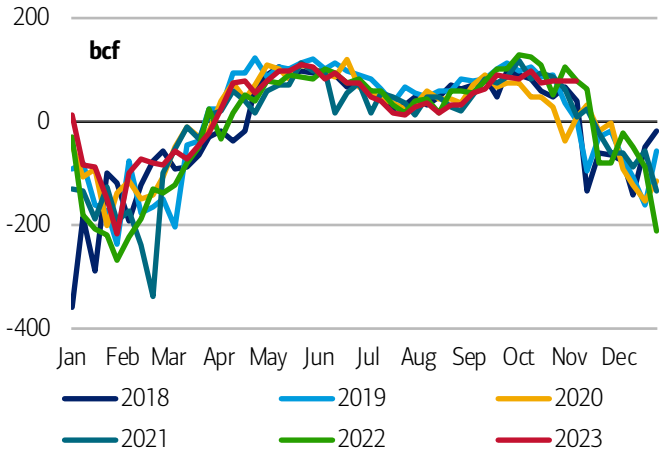
...which helped narrow the US gas storage surplus

The market has watched the perfect storm driving record natural gas use in the power sector and wondered how long it will persist. Strong power burns have lasted much longer than most anticipated and inventories have been building at a much slower pace as a result. Since April, inventory builds have averaged just 63Bcf per week versus a five-year average weekly pace of 65Bcf and 74Bcf last year (Exhibit 156). Expectations for 4+ Tcf end of 2023 season storage levels slowly faded with underwhelming inventory builds, and inventories have also started to drift toward five-year average levels. Indeed, since May, inventories have dropped from 370Bcf above the five-year average to ~200Bcf above normal as of mid-November (Exhibit 157).

Exhibit 156: US L-48 natural gas inventory injections
Since April, inventory builds have averaged just 63Bcf per week versus a five-year average weekly pace of 65Bcf and 68Bcf last year...



Source: Bloomberg, BofA Global Research

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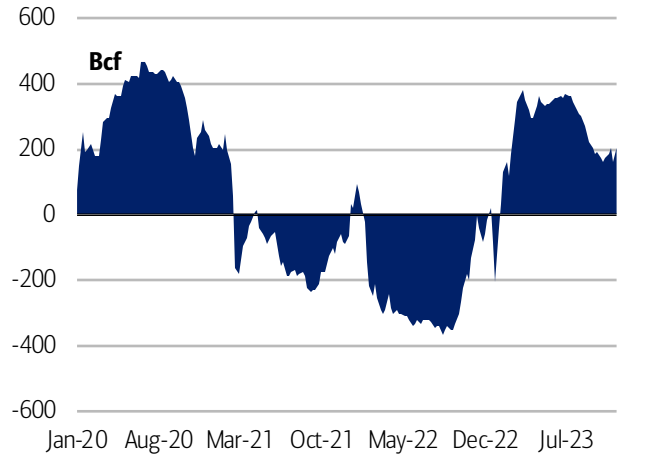
Exhibit 157: US L-48 inventories versus the five-year average
...which has caused inventories to fall from 370Bcf above the five-year average to ~200Bcf above as of mid-November



Source: Bloomberg, BofA Global Research

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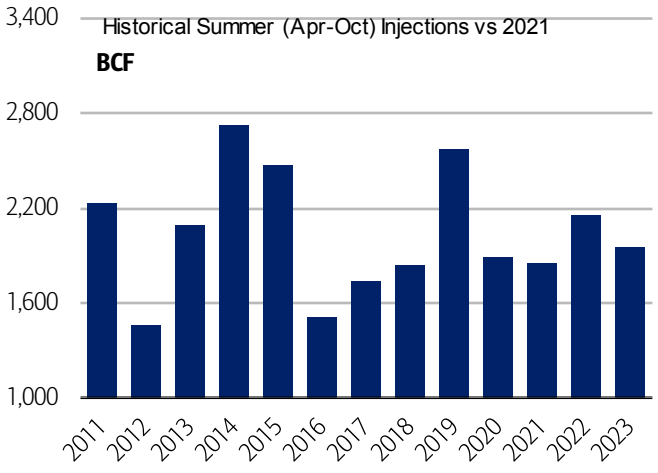
Storage hit 3.78Tcf in Oct '23, expected to hit 3.95Tcf in Oct '24...

Even though inventory builds have come in slower than average recently, we still expect inventory builds during storage season (April-October) to come in at the high end of the range compared to recent history (Exhibit 158). Storage rose roughly 1.95Tcf during April-October this year, a 200bcf decline YoY, and 170bcf lower than the previous five-year average. As of mid-November inventories are at 3.83Tcf and we see them dropping toward 1.9Tcf at the end of March (Exhibit 159). In 2024, we expect inventories to exceed 3.9Tcf by end of season, which would likely put pressure on forward Henry Hub prices compared to the curve.

Exhibit 158: Historical and projected summer (Apr-Oct) Injections
Storage rose 1.9Tcf this year, a 30bcf decline YoY, and 68Bcf lower than the previous five-year average



Source: Bloomberg, BofA Global Research

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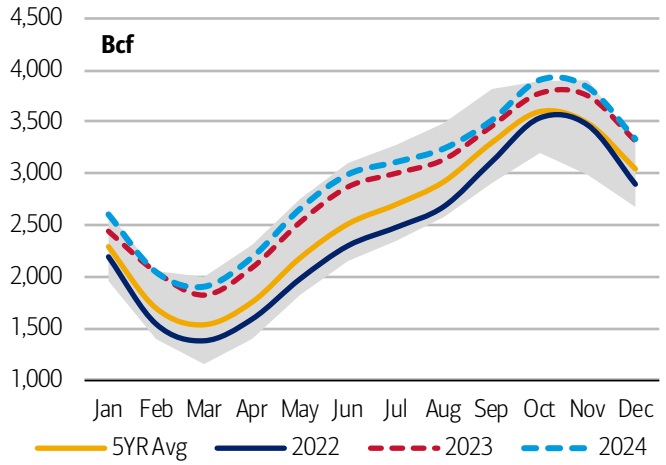
Exhibit 159: US natural gas storage history and forecast
Inventories hit 3.78Tcf at the end of October and should drop toward 1.9Tcf at the end of March



Source: Bloomberg, EIA, BofA Global Research estimates

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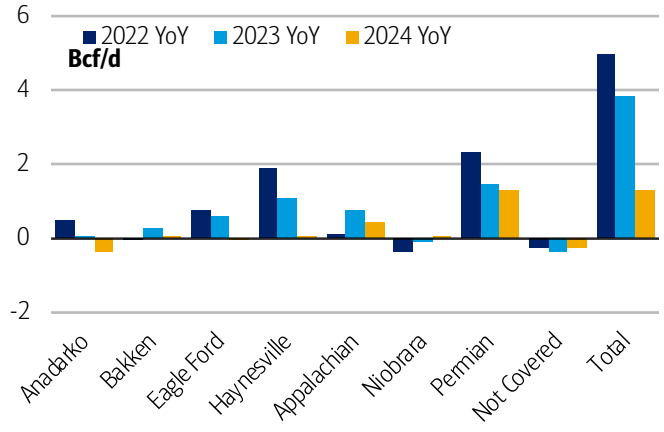
...as supply growth slows from 3.9Bcf/d YoY in '23 to 0.6Bcf/d in '24...

US natural gas supply has been surprisingly resilient this year, with output topping 103.6Bcf/d in August, according to the EIA. Total lower 48 gas supply growth is likely to average 3.9Bcf/d YoY this year due primarily to resilient supply in the Haynesville and steady supply growth in the Permian (Exhibit 160). Next year, we think supply should rise by a much more subdued 1.3Bcf/d, led by Permian associated gas supply growth tied partly to the startup of expansions on the Permian Highway and Whistler pipelines later this year and the 2.5Bcf/d Matterhorn pipeline in 2024. By the end of 2024, we expect US production will reach 105.1Bcf/d (Exhibit 161).

Exhibit 160: US L-48 natural gas supply growth
Next year, we think supply should rise by a much more subdued 1.3Bcf/d, led by Permian associated gas supply growth



Source: EIA, Genscape, Rystad Energy, BofA Global Research estimates

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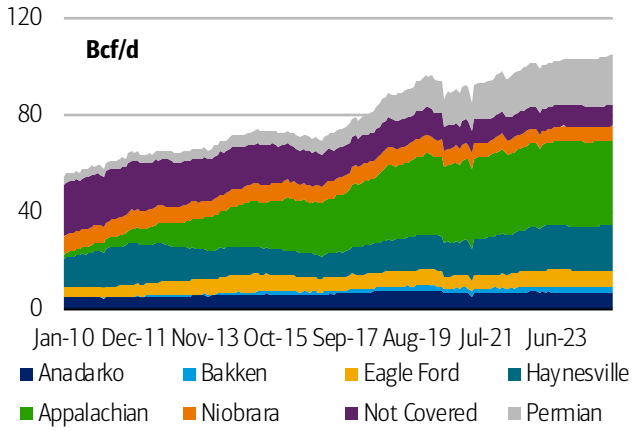
Exhibit 161: US L-48 natural gas supply
By the end of 2024, we expect US production will reach 105.1Bcf/d



Source: EIA, Genscape, Rystad Energy, BofA Global Research estimates

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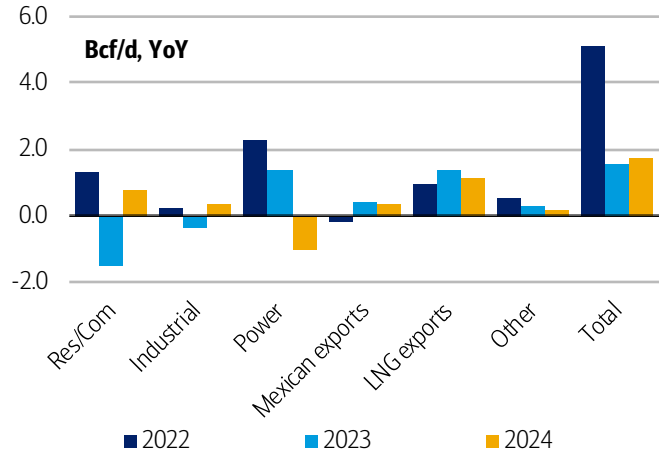
...while demand growth rises from 2.1Bcf/d in '23 to 2.6Bcf/d in '24

Demand growth has been mixed across different sectors this year, with industrial, residential, and commercial demand falling YoY, while demand from the power sector, LNG, and Mexico exports have come in higher (Exhibit 162). In total, we expect demand to rise 2.1Bcf/d YoY in 2023 led by power (1.8Bcf/d) and LNG (1.5Bcf/d) and another 2.6Bcf/d next year as rising LNG demand (1.4Bcf/d) and recovering residential and commercial demand (0.7Bcf/d) helps offset lower power demand (-0.9Bcf/d). In total, we expect natural gas demand to average 106.6Bcf/d this year before rising to 109.2Bcf/d in 2024 (Exhibit 163).

Exhibit 162: US natural gas demand growth by sector
We expect demand to rise 1.6Bcf/d YoY in 2023 led by power (1.4Bcf/d) and LNG (1.4Bcf/d) and another 1.8Bcf/d next year...



Source: EIA, Genscape, BofA Global Research estimates

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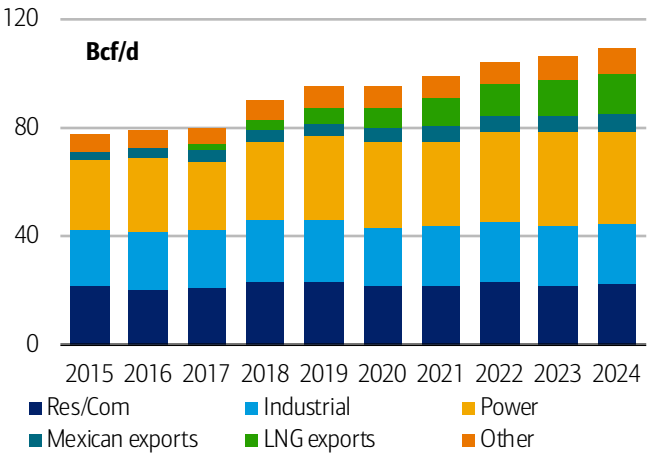
Exhibit 163: US natural gas demand by sector
...leading to total demand of 106.6Bcf/d this year and 109.2Bcf/d next



Source: EIA, Genscape, BofA Global Research estimates

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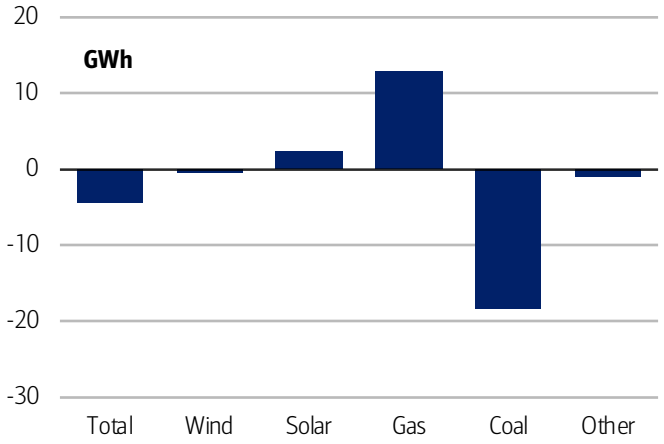
Gas power burns to slow in '24 on milder temperatures...

Total US lower 48 power generation averaged about 4GWh lower YoY from January to October, with coal generation down more than 18GWh and gas up 13GWh (Exhibit 164). Over the same period, solar has tracked higher by more than 2GWh and wind declined by an average of just over 300MWh as low wind speeds more than offset wind capacity growth. During the April-August timeframe, wind's performance was worse, averaging just over 43GW, a decline of nearly 4GWh YoY. In May wind generation fell nearly 13

GWh lower YoY thanks to multi-decade low wind speeds. The relationship between natural gas generation and temperatures shifted noticeably higher this year as gas made in-roads versus coal and helped fill in for poor wind performance and heavy nuclear maintenance (Exhibit 165). This relationship could revert somewhat next year if renewables performance is better, or coal generation picks up again.

Exhibit 164: US L-48 net generation by fuel (January-October)
Total US lower 48 power generation tracked ~4GWh lower YoY from January to November, with coal generation down more than 18GWh and gas up 13GWh



Source: Bloomberg, BofA Global Research

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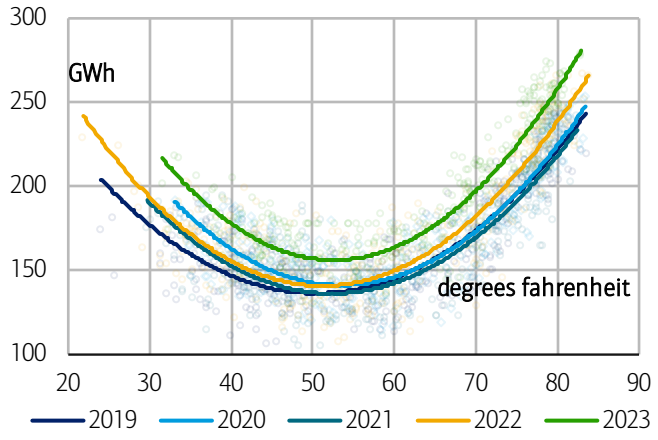
Exhibit 165: Lower 48 gas generation versus temperature
The relationship between natural gas generation and temperatures shifted noticeably higher this year



Source: Bloomberg, BofA Global Research

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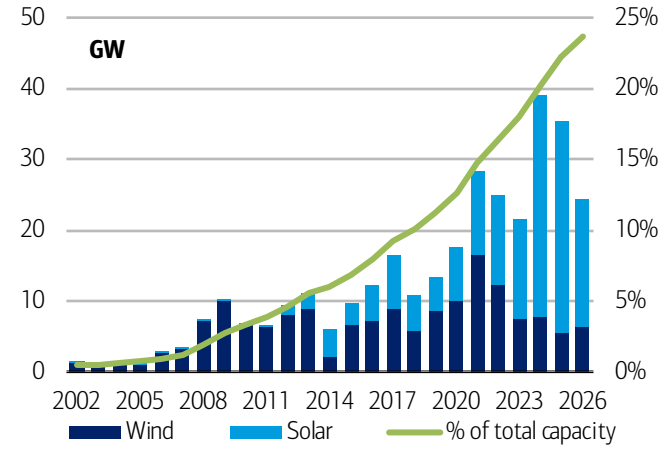
...more renewables and nuclear capacity, more competitive coal...

US renewables capacity additions are expected to slow by roughly 2.4GW to about 23GW YoY in 2023 and before rising to a new record of 38GW YoY in 2024 (Exhibit 166). Renewables growth consisted primarily of wind installations over the past two decades, but solar has made in-roads more recently. If realized, utility scale solar could see more than 30GW of new installed capacity next year, marking an annual growth rate of nearly 40%. Adjusting for smaller scale solar this growth rate is likely to be even higher. Solar has performed well this year, helping offset lower wind generation this year, and with significant capacity growth later this year and next, it seems likely that solar generation would be flat YoY even in a bear-case scenario. On the thermal side, coal capacity retirements are set to rise this year to more than 13GW, up from nearly 11GW in 2022 (Exhibit 167). The pace of retirements is set to slow to just 6GW in 2024, the slowest level since 2017. Meanwhile, gas capacity is likely to grow 4.7GW this year and less than 1GW in 2024.

Exhibit 166: Utility scale solar and wind capacity additions (year-end)
US renewables capacity additions should slow by roughly 2.4GW to about 23GW YoY in 2023 and before rising to a new record of 38GW YoY in 2024



Source: EIA, BofA Global Research

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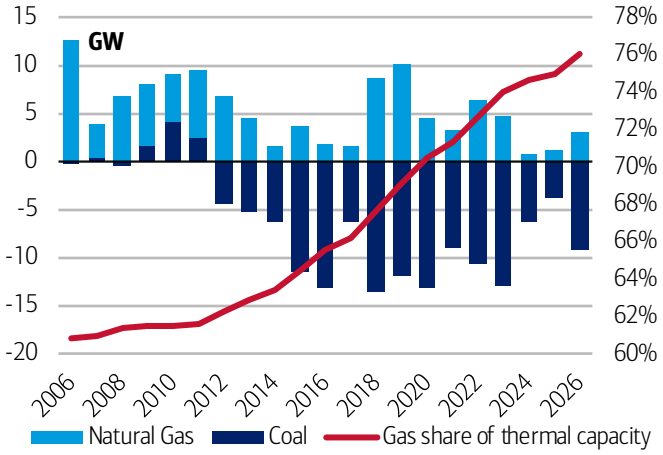
Exhibit 167: Coal and natural gas fired power sector capacity additions
On the thermal side, coal capacity retirements are set to rise this year to more than 13GW before slowing to 6GW in 2024



Source: EIA, BofA Global Research

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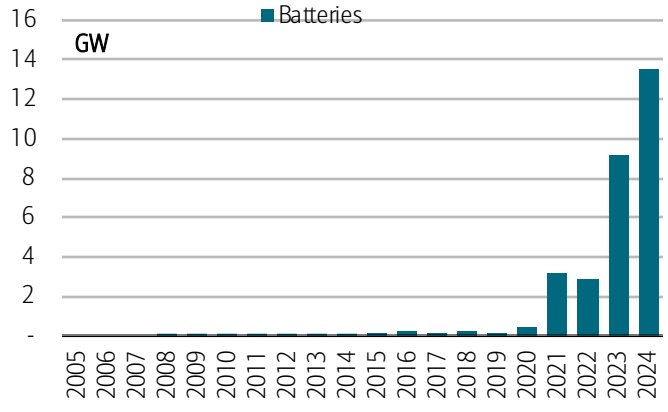
...and to a much smaller degree, rising grid scale battery capacity

Grid scale battery capacity is still small relative to sources of power generation, but capacity growth is accelerating (Exhibit 168). In 2024, nearly 14GW of battery capacity is likely to be tied into the grid, helping to ease the burden of swings in electricity demand on power generators (Exhibit 169). In the US, average ytd coal and gas generation has swung from a low of around 230GWh during the early hours of the morning to a high of about 320GWh during the evening peak. Batteries will help smooth out this generation profile, increasing electricity demand during periods of lower end-use demand and delivering power to the grid and lowering generation requirements during periods of high end-use demand. This will also mean that the call on less efficient power generators is lower during peak periods, which could have a more meaningful impact on power sector gas demand than topline generation figures might imply.

Exhibit 168: Annual US grid battery capacity additions
In 2024, nearly 14GW of battery capacity is likely to be tied into the grid...



Source: EIA, BofA Global Research

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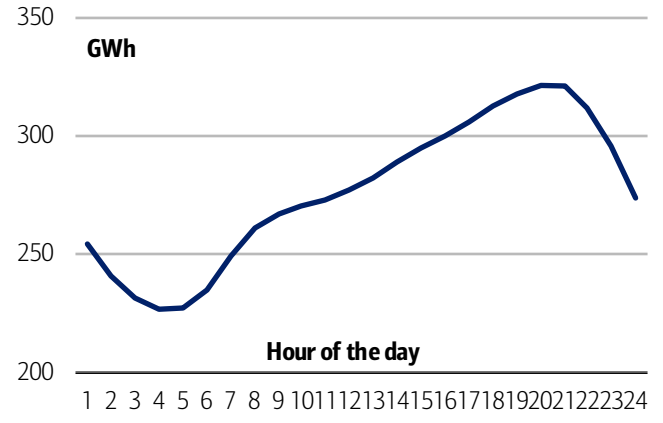
Exhibit 169: YTD average thermal generation by hour (coal and gas)
...helping to ease the burden of swings in electricity demand on power generators



Source: Bloomberg, BofA Global Research

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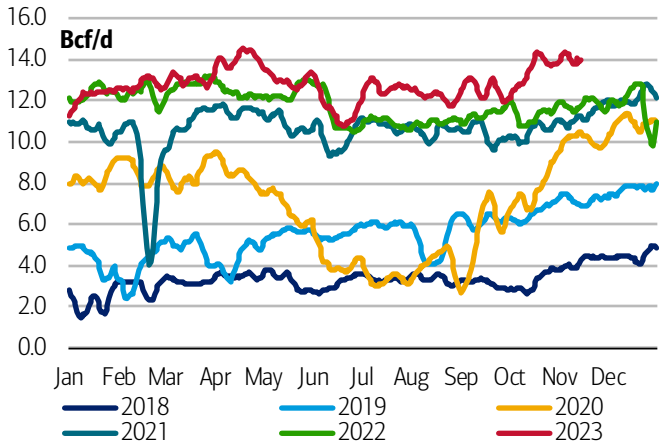
Meanwhile, capacity additions lift LNG demand 1.4Bcf/d in '24...

US LNG terminal natural gas receipts tracked just 230mmcf/d higher YoY into 1Q23 as an extended Freeport LNG outage offset the startup of the Calcasieu Pass LNG facility, but Freeport has since restarted and volumes have picked up, growing 840mmcf/d in 2Q23, even as heavy maintenance at Sabine Pass weighed demand (Exhibit 170).

Volumes rose further in 3Q23 yielding a growth rate of just over 1.3bcf/d YoY, bringing ytd gains to 1bcf/d. Volumes should rise through winter as temperatures cool and plant efficiencies rise, continuing to exceed 14Bcf/d through the year-end. As Plaquemines LNG phase 1 starts up in 2H24 and the first train of Golden pass starts in mid-2024, volumes should near 17Bcf/d (Exhibit 171).

Exhibit 170: LNG export terminal natural gas receipts
After an extended Freeport outage into 1Q23, US LNG terminal gas receipts have recovered seasonally, bringing ytd growth to about 1bcf/d



Source: Bloomberg, BofA Global Research

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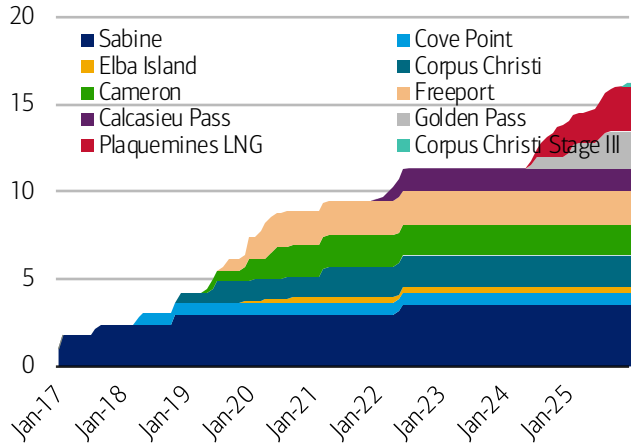
Exhibit 171: Baseload LNG export capacity
LNG terminal receipts should continue to exceed 14Bcf/d through 2023 and rise towards 17Bcf/d by year-end 2024 as Plaquemines and Golden pass startup



Source: Company Reports, BofA Global Research estimates

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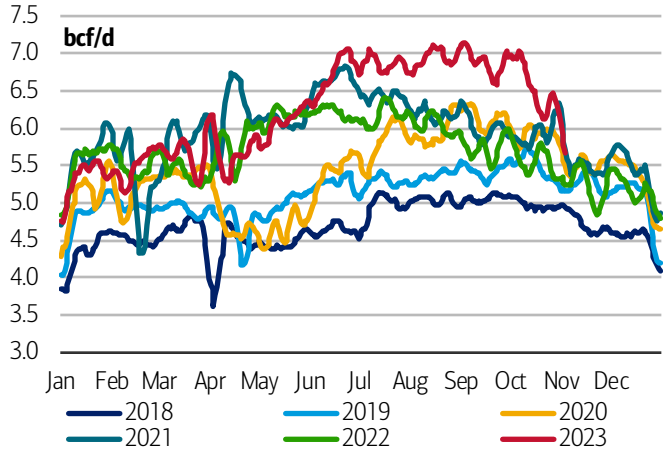
...and exports to Mexico to rise 0.4Bcf/d over the same period

Mexico exports have been a key source of demand growth for the US gas market over the past decade, but exports got off to a slow start in 1H23, averaging just 70mmcf/d higher YoY but 100mmcf/d lower than 1H21 (Exhibit 172). However, exports soared higher in the summer, reaching new record high levels and averaging more than 800mmcf/d higher YoY June through September. Despite recent declines we expect demand from Mexico to remain historically strong into year-end, leading to 500mmcf/d of growth YoY in 2023 and we also expect volumes to rise an additional 300mmcf/d YoY in 2024, aided by the ramp of the New Fortress Energy Altamira LNG facility. Inbound gas volumes from Canada to the US were also sluggish during the first half of the year, partly due to wildfires during the spring and narrow export arbs, but shipments have picked up since mid-year (Exhibit 173), similar to US exports to Mexico. During the first half of the year, net imports averaged 5.2bcf/d, a decrease of more than 600mmcf/d over the same period in 2022. In 2H23, imports from Canada have averaged 5.7bcf/d, a marginal increase YoY. In 2023 and 2024, we expect US imports from Canada will decline 400mmcf/d YoY in 2023 and rise 300mmcf/d in 2024.

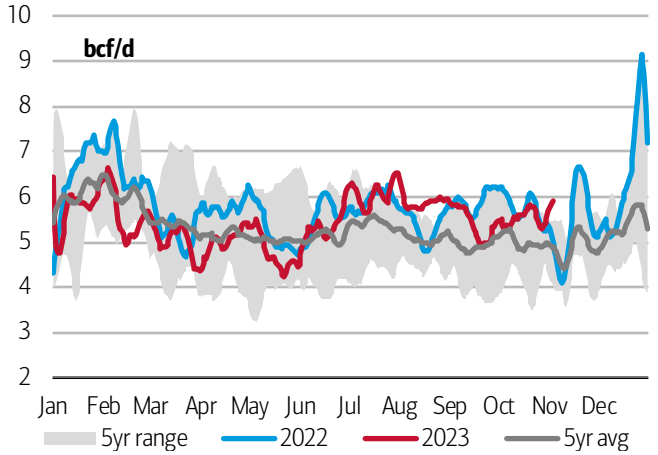
Exhibit 172: US natural gas exports to Mexico
US gas exports to Mexico picked up significantly over the summer, reaching new record high levels and averaging more than +800mmcf/d YoY



Source: Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 173: US natural gas imports from Canada
Gas imports from Canada were sluggish during 1H23, partly due to wildfires and narrow export arbs, but shipments have picked YoY since mid-year



Source: Bloomberg, BofA Global Research

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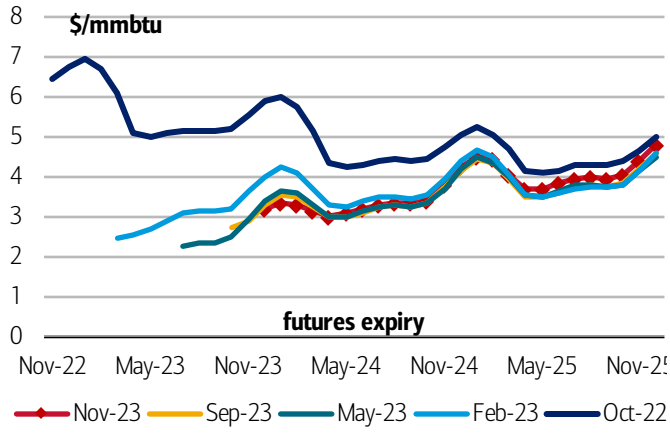
We forecast Henry Hub prices will average $3/mmbtu in 2024…

The natural gas forward curve has come down dramatically since mid-2022 when the Henry Hub cal-2023 strip was averaging more than $6.50/mmtbu and the cal-2024 strip traded nearly $5.40/mmtbu (Exhibit 174). Since we put out price forecast update in February (see our report, US nat gas rollercoaster nears the bottom), prices have come down toward our 2023 forecast and have averaged $2.67/mmbtu ytd. We are bearish versus the forward curve in 2024 and expect Henry Hub prices to average $3/mmbtu as the market continues to struggle with seasonally high inventory levels (Exhibit 175). Next spring, we could see prices dipping back below $2/mmbtu if inventories come out of winter at lofty levels.

Exhibit 174: Henry Hub natural gas forward curve
Henry Hub prices have averaged $2.67/mmbtu ytd



Source: Bloomberg, BofA Global Research

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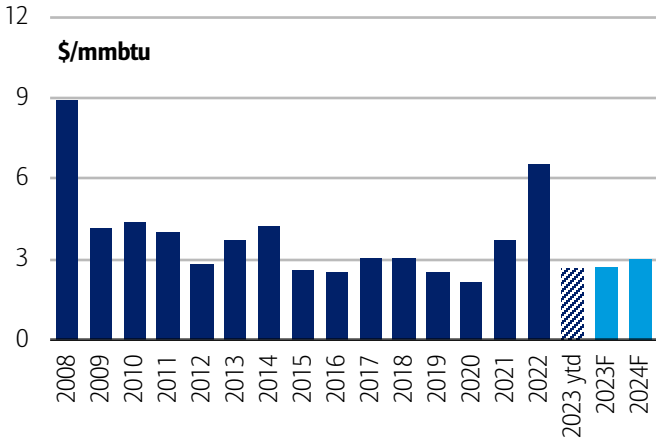
Exhibit 175: US Henry Hub natural gas price history and forecast
We are bearish versus the forward curve in 2024 and expect Henry Hub prices to average $3/mmbtu



Source: Bloomberg, BofA Global Research estimates

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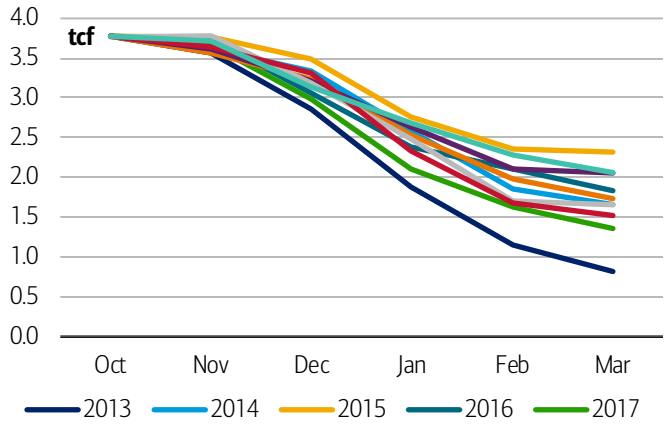
…but weather can still tilt the market bullish or bearish by winter's end

A warm winter in 2022/23 left the US natural gas market with inventories near five-year high levels in March of 2023 and presented the possibility of inventories exceeding 4Tcf by the end of storage season. After exceptionally warm weather helped chip away at inventory builds, storage likely exited October at roughly 3.78Tcf and has since grown, putting it 200Bcf above five-year average levels as of mid-November. Using historical

storage builds/draws as a guide, inventories could exit winter as low as 820Bcf or as high as 2.3Tcf, but most paths suggest storage will end closer to 1.7-1.8Tcf (Exhibit 176). Weather can affect demand for natural gas, but it can also affect supply. Despite being a mild winter in 2022/23, a cold blast in December caused record freeze-offs, which took winter gas production down by an estimated 155Bcf (Exhibit 177).

Exhibit 176: US natural gas inventory scenarios assuming historical winter inventory drawdowns from current inventory levels
Inventories could exit winter as low as 820Bcf or as high as 2.3Tcf, but most paths suggest storage will end closer to 1.7-1.8Tcf



Source: Bloomberg, BofA Global Research estimates

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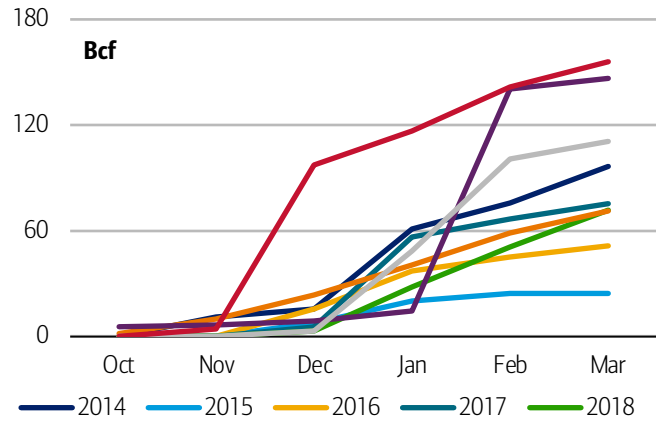
Exhibit 177: US L-48 natural gas freeze-offs
Despite being a mild winter in 2022/23, a cold blast in December caused record freeze-offs, which took winter gas production down by an estimated 155Bcf



Source: Genscape, BofA Global Research

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Global LNG dynamics could start to play a role again too

We have previously discussed the risk premium that cropped up in Henry Hub prices during 2021 and 2022 and led to a material disconnect in the price/inventory relationship, but higher US inventories and lower global gas prices have caused that dynamic to fade in 2023. Even though inventories in Europe are near five-year highs, any large disruption to supply such as from LNG export facilities or otherwise could cause inventories to tighten and prices to rise. While this may not directly impact US natural gas balances, higher TTF prices would likely bleed into Henry Hub prices via a higher risk premium associated with the probability of needing to shut-in exports or destroy domestic demand. With US inventories trending 200Bcf above the five-year average, the probability that this would need to occur is low, but a cold winter could quickly change the backdrop.

3. Industrial metals outlook

3.1 Aluminum

Overview

While aluminium has fallen as China's re-opening trade has faded, prices have been supported at around $2,200/t ($1/lb), partially on costs. China's smelters briefly operated at full capacity this year, but the domestic market has been able to absorb all those units (partially on green spending), on top of 1Mt of Russian aluminium imports. While demand will likely remain soft ex-China near-term, lack of supply growth should keep the aluminium market tight. Meanwhile, an acceleration of global growth into 2H24 is set to push prices higher again.

Exhibit 178: Aluminium supply and demand balance
The aluminum market should remain tight

'000 tonnes	2022	2023	2024	2025	2026
Global production	68,412	70,338	73,363	73,793	74,333
YoY change	1.3%	2.8%	4.3%	0.6%	0.7%
Global consumption	69,106	71,074	74,842	77,836	80,949
YoY change	0.7%	2.8%	5.3%	4.0%	4.0%
Balance	**-694**	**-736**	**-1,479**	**-4,043**	**-6,617**
Market inventories	8,448	7,711	6,232	2,189	
Weeks of world demand	6.4	5.6	4.3	1.5	
LME Cash ($/t)	**2,706**	**2,268**	**2,563**	**3,000**	**3,250**
LME Cash (c/lb)	**123**	**103**	**116**	**136**	**147**

Source: SNL, Woodmac, CRU, Bloomberg, company reports, IAI, BofA Global Research

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Restrained global aluminium production growth

The latest run of global aluminium production shows that smelters ex-China have had little appetite for boosting production, with supply increasing by just 0.5% YoY YTD (January to September). Meanwhile, operators in China raised output by 4.1% YoY in September, partially because 2.3Mt of capacity was restarted at smelters in Yunnan province. Yet, continued issues around hydro power supplies have prompted operators in the region to again shutter around 1.2Mt of capacity since and those potlines are unlikely to restart until mid-2024.

Exhibit 179: Global aluminium production
Aluminium production is up 1.8% YoY YTD; China is now operating close to its capacity cap of 45Mt

	YTD 2023	YTD 2022	YoY change	Annualised Sep-23	Annualised Sep-22	YoY change	Annualised Aug-23	MoM change	YTD 2023 Annualised	2023 S/D model	Model v YTD Delta
Africa	1,192	1,215	-1.9%	1,618	1,643	-1.5%	1,590	1.8%	1,589	1,646	56
North America	2,892	2,801	3.2%	3,918	3,662	7.0%	3,909	0.2%	3,856	4,058	202
Latin America	1,090	928	17.5%	1,509	1,399	7.8%	1,472	2.5%	1,453	1,689	236
Asia	3,493	3,426	2.0%	4,696	4,623	1.6%	4,686	0.2%	4,657	5,930	1,273
West Europe	2,028	2,221	-8.7%	2,713	2,884	-5.9%	2,708	0.2%	2,704	3,130	426
E.Europe	2,995	3,061	-2.2%	3,979	4,039	-1.5%	3,980	-0.0%	3,993	4,049	56
Oceania	1,403	1,368	2.6%	1,886	1,837	2.6%	1,884	0.1%	1,871	1,958	87
Middle East	4,573	4,542	0.7%	6,083	6,096	-0.2%	6,087	-0.1%	6,097	6,710	613
Other non-IAI nations	1,836	1,836	0.0%	2,446	2,446	0.0%	2,461	-0.6%	2,448	0	-2,448
IAI ex-China	21,502	21,398	0.5%	28,847	28,628	0.8%	28,776	0.2%	28,669	29,170	500
China	30,924	30,098	2.7%	42,583	40,917	4.1%	42,470	0.3%	41,232	40,601	-631
IAI Total	**52,426**	**51,496**	**1.8%**	**71,431**	**69,545**	**2.7%**	**71,246**	**0.3%**	**69,901**	**69,770**	**-131**

Source: IAI, BofA Global Research

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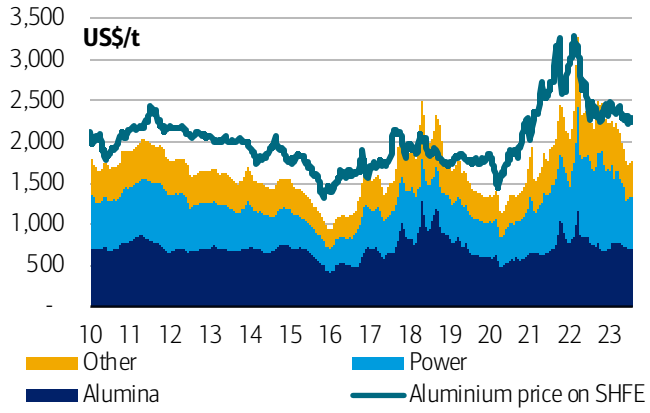
China's smelters don't take advantage of margins

The lack of production increases YTD is worth noting when we keep in mind that profit margins at an "average" Chinese smelter purchasing spot coal and alumina are positive, as our real-time cost estimator highlights (Exhibit 3). This is somewhat unusual because operators would not have left money on the table in the past; i.e. profits usually lead to output increases. In our view, this shows that China's 45Mt capacity cap still holds.

Exhibit 180: China, cash cost estimator on spot coal and alumina
Profit margins of an "average" smelter in China are positive



Source: Bloomberg, BofA Global Research

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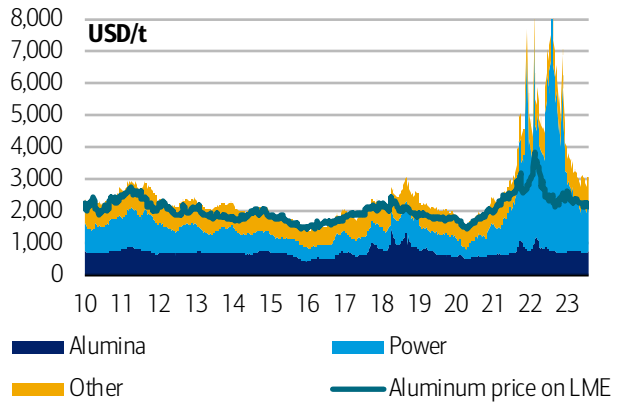
Exhibit 181: Europe, cash cost estimator on spot electricity and alumina
Headwinds for European smelters have subsided somewhat



Source: Bloomberg, BofA Global Research

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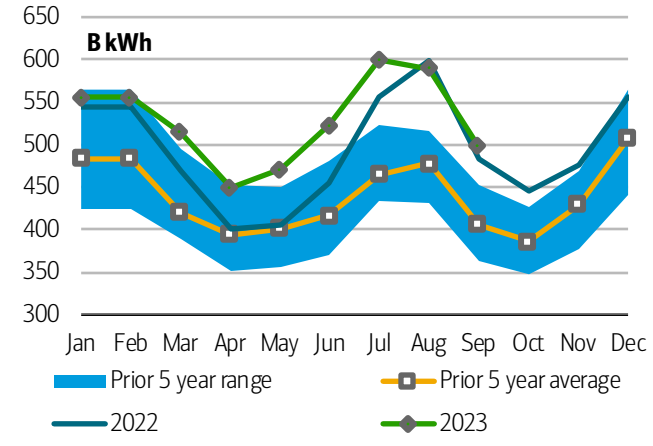
Meanwhile, if production costs at smelters in Europe are valued at spot power prices, operators in the region are still hurting. While the immediacy of the energy crisis has subsided, it has not been resolved. Hence, the incentive to restart production is very low. In fact, we see a risk that more smelters will be closed in the region. Similarly, there is continued discussion as to whether capacity will be shut at US smelters.

China's hydro power backdrop remains challenging

Operators in Yunnan province had idled around 2Mt of capacity over electricity shortages, as hydro power generation ran at multi-year lows earlier this year. Smelters in the region reactivated facilities over the summer (see our report, Chalco (H): Mgmt call: Optimistic about aluminum price and margin to expand in 2H23, 29 August 2023), but those tonnages did not lead to weaker fundamentals on the physical market. Since then, and highlighting continued issues with power supplies, operators have announced that around 1.2Mt of capacity will be closed again, units that the domestic market will likely miss.

Exhibit 182: China, thermal power generation
Thermal power generation has been elevated



Source: Bloomberg, BofA Global Research

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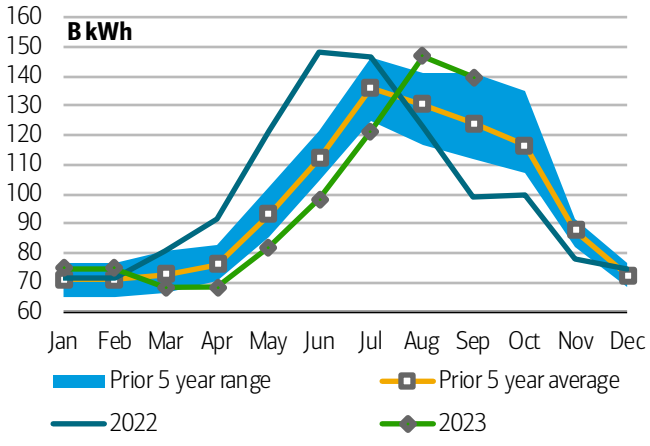
Exhibit 183: China, hydro power generation
Hydro power generation has been running at multi-year lows



Source: Bloomberg, BofA Global Research

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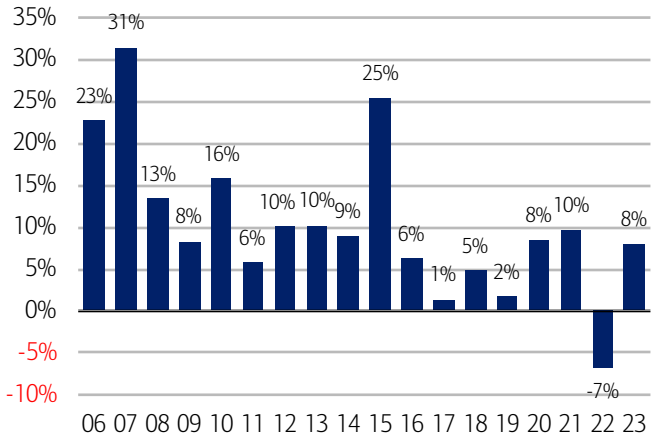
China's demand holds up, exports contained

Indeed, switching to demand, Exhibit 184 shows that China's apparent consumption of aluminium has been holding up, expanding by 8% YoY YTD, with purchased tonnages consistently above last year's levels, except in April, when concerns over the health of

China's economy escalated. The dynamic behind that has also been reflected in comments from Chalco management, which outlined that despite the shrinking property market, a lifting of housing restrictions, along with rising investment in other sectors like solar/new energy vehicles/infrastructure projects, should be supportive to aluminium consumption.

Exhibit 184: China, apparent aluminium demand
Aluminium consumption has risen by 8% YoY



Source: Bloomberg, CRU, BofA Global Research

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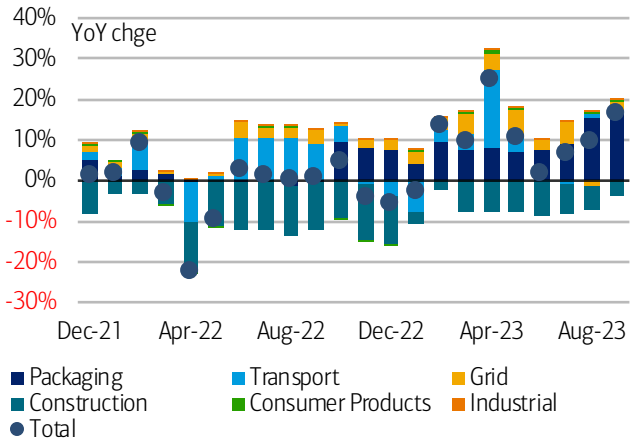
Exhibit 185: China, breakdown of aluminium demand growth
Demand growth has been patchy



Source: Bloomberg, BofA Global Research

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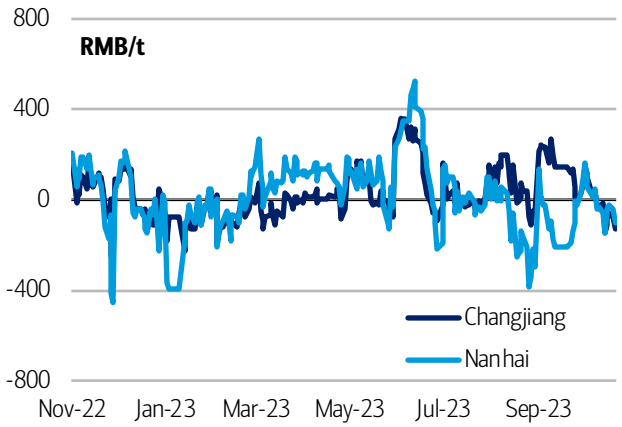
Exhibit 186 shows the implications: steady demand growth, alongside production discipline, has contributed to keeping physical premia supported. Meanwhile, Exhibit 187 outlines that SHFE aluminium prices have been trading above those on the London Metals Exchange in recent months. The implications? If China's government manages to reboot the economy in 2024, the domestic market may be able to absorb some of the additional aluminium units once smelters in Yunnan re-start again, and potentially also the Rusal tonnages.

Exhibit 186: China, physical premia
The physical market has been well supported



Source: Bloomberg, BofA Global Research

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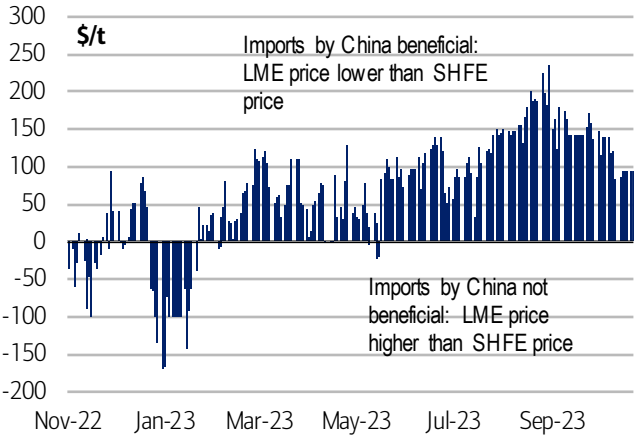
Exhibit 187: Price differentials, Shanghai Futures Exchange and London Metal Exchange
Aluminium has been trading at a premium in Shanghai for most of 2023



Source: Bloomberg, BofA Global Research

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3.2 Copper

Overview

As the global economy has slowed through 2023, copper has been supported by China's investment in the grid and rising car production, although mine supply disruptions have also contributed to the resilience in prices. While green spending in China may slow, the housing market should become less of a drag. This, along with a rebound of demand ex-China and a gradual emptying of the mine project pipeline, should reduce the supply overhang, with copper likely posting the first full-year deficit in 2025.

Exhibit 188: Copper supply and demand balance
Copper moving back into small, temporary surplus

'000 tonnes	2022	2023	2024	2025	2026
Global production	24,646	25,983	27,195	27,659	28,374
YoY change	2.2%	5.4%	4.7%	1.7%	2.6%
Global consumption	25,152	25,694	27,052	28,134	29,260
YoY change	0.9%	2.2%	5.3%	4.0%	4.0%
Balance	**-506**	**289**	**143**	**-476**	**-886**
Market inventories	658	947	1,090	614	
Weeks of world demand	1.4	1.9	2.1	1.1	
LME Cash ($/t)	**8,822**	**8,442**	**8,625**	**10,500**	**9,500**
LME Cash (c/lb)	**400**	**383**	**391**	**476**	**431**

Source: SNL, Woodmac, CRU, Bloomberg, company reports, ICSG, BofA Global Research

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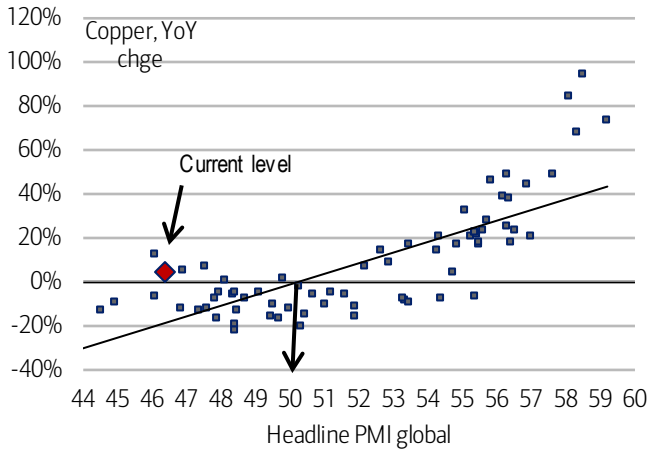
China's green spending generates around 5% of global demand growth

Copper prices have been resilient notwithstanding the global slowdown (Exhibit 189). This has been heavily influenced by investment in the grid and continued strong car production in China (Exhibit 190; see our Global Metals Weekly: Copper's beta to GDP growth is declining 08 August 2023).

Exhibit 189: Global (US, Europe, China) average PMIs and copper prices
Copper prices have been resilient



Source: Bloomberg, BofA Global Research

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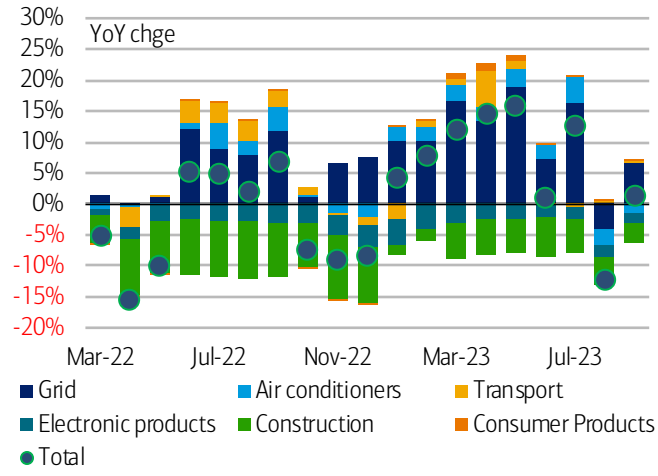
Exhibit 190: China, breakdown of copper demand
Green technologies have supported copper demand



Source: Bloomberg, BofA Global Research

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Supply issues persist

Most miners have reduced production guidance

At the same time, supply remains an issue, with Exhibit 191 and Exhibit 6 highlighting that only 1 of the 10 largest copper producers (this excludes Zijin) raised 2023 production guidance.

Exhibit 191: 2023 production guidance from the 10 largest miners
8 of the 10 largest miners have reduced 2023 production guidance

	4Q22	3Q23	Change
Codelco	1,385	1,320	-65
Freeport	1,951	1,814	-136
BHP	1,730	1,717	-13
Glencore	1,060	1,040	-20
Southern Copper	926	932	6
Anglo American	885	885	0
First Quantum	805	805	0
KGHM	607	607	0
Antofagasta	690	655	-35
Rio Tinto	680	615	-65
Teck	418	353	-65
Total	**11,136**	**10,743**	**-393**

Note: Freeport is sales guidance, BHP figures consolidate Escondida and is per fiscal year
Source: company reports, BofA Global Research

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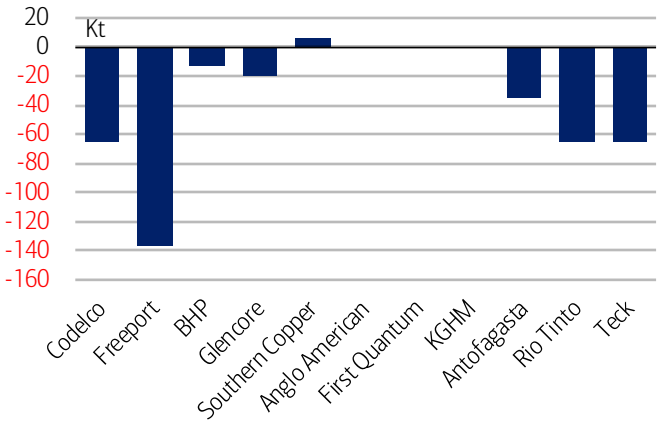
Exhibit 192: Change in 2023 production guidance
Zijin is the only miner to have visibly overdelivered relative to original guidance



Note: Freeport is sales guidance, BHP figures consolidate Escondida and is per fiscal year
Source: company reports, BofA Global Research

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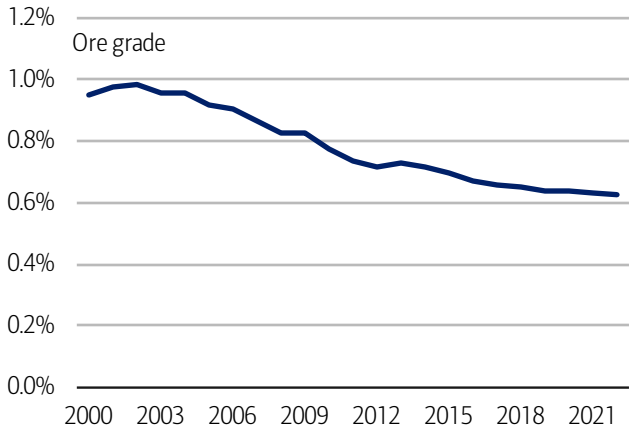
Operational challenges reflected in production costs

While many of the challenges at the miners relate to operational issues, these headwinds are nothing new. Indeed, the issues have been reflected in virtually every market metric.

Exhibit 193 highlights that ore grades have fallen steadily. Exhibit 194 takes the decline in ore grades a step further, showing that this has been an important factor behind rising production costs: in essence, lower ore grades means that more material needs to be moved to produce one tonne of copper and this is expensive.

Exhibit 193: Evolution of ore grades
Ore grades have declined over the past two decades



Source: Woodmac, BofA Global Research

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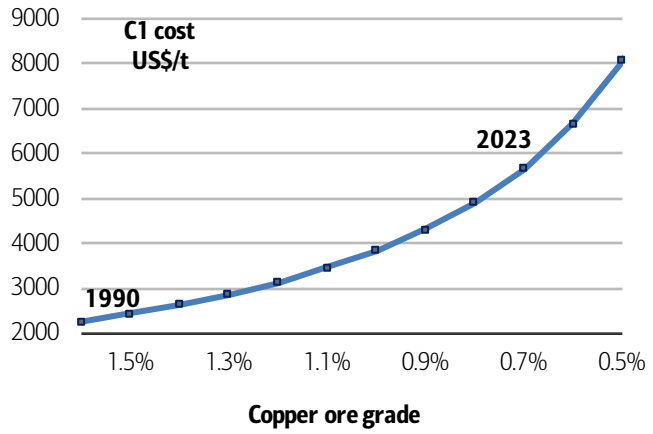
Exhibit 194: Ore grades and production costs
The reduction in ore grades has pushed up operating costs



Source: Woodmac, BofA Global Research

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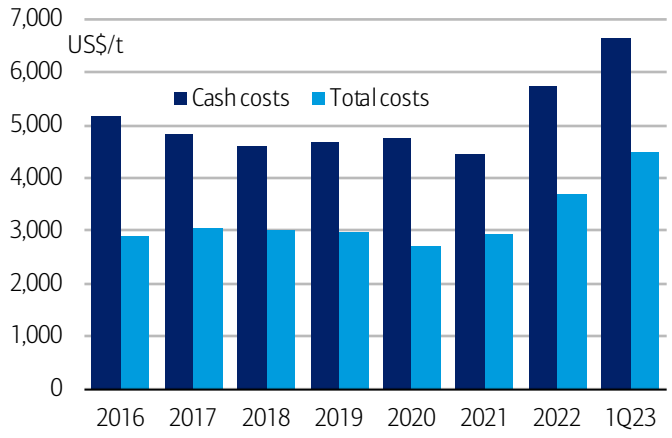
The cost inflation is also reflected in Exhibit 195, which highlights that copper production expenses have hit record highs. There is a silver lining: higher costs means that the floor under copper prices has shifted up. Taking the 75th-95th percentile of production costs as a reference, it would be hard for copper prices to fall below $5,500/t ($2.50/lb) at present. To put this into context, the lowest price during the Covid pandemic was $4,371/t ($1.98/lb).

Exhibit 195: Chile, copper production costs
Chile's total production costs now run at $6,600/t ($2.99/lb)



Source: Cochilco, BofA Global Research

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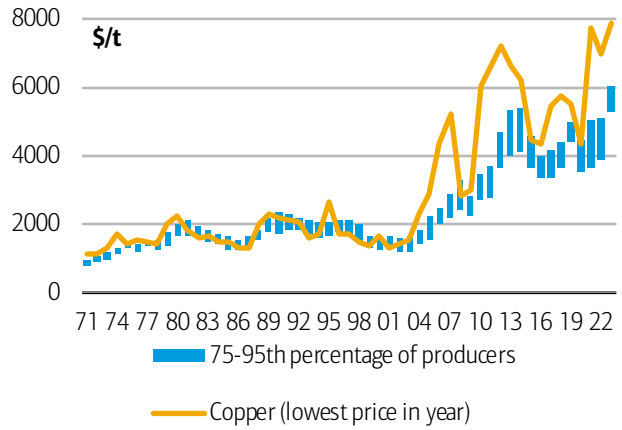
Exhibit 196: Production costs and copper prices
Production costs have supported copper prices



Source: Bloomberg, Woodmac, BofA Global Research

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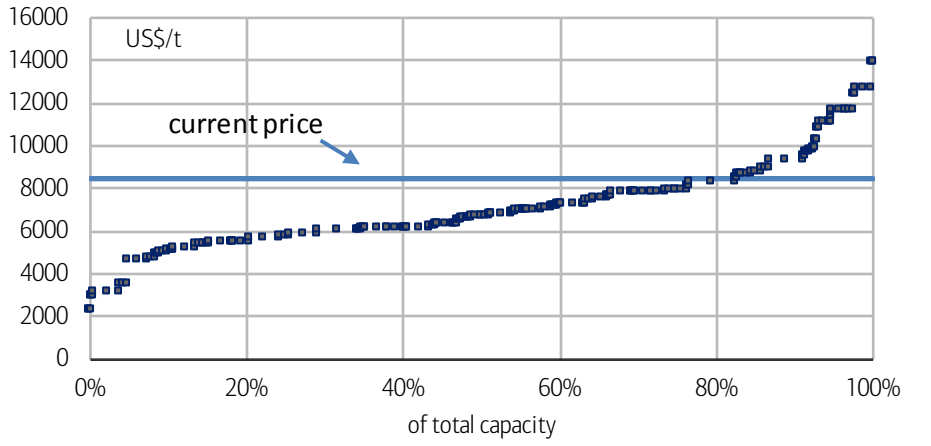
But cost inflation has not been an issue just for current operations. The following chart outlines that around 20% of all the projects currently in the pipeline would not break even.

Exhibit 197: Project incentive prices and copper prices
Current copper prices are too low for many projects, assuming 15% required return on capital



Source: Woodmac, BofA Global Research

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As for the lack of production growth, the reluctance to bring new mines to market has also been reflected in comments from Glencore, which recently fully acquired the 200Kt MARA copper project in Argentina. As the company outlines, MARA is a brownfield project, with very low capital intensity and a life of nearly 30 years. It will be a top 25 producer for the first 10 years of its life at production of at least 200,000 tonnes of copper. Looking into bringing the mine online, the company's CEO Gary Nagle outlined that the world is starting to recognize the impending shortage of copper over the next few years, and this will be one of the first projects that can feed into that demand. Yet he also noted that copper prices need to be higher before the project will be brought online. Keep in mind that operating costs during pre-feasibility studies were estimated at $3,000/t ($1.5/lb)!

3.3 Nickel

Overview

The nickel market is becoming increasingly complex. With different products catering for a variety of sectors, aggregate global balances lose relevance somewhat. That said, China's nickel market participants have boosted supply in Indonesia, also giving themselves the flexibility to switch between different products. This should keep the nickel market well supplied, likely capping prices for now.

Exhibit 198: Nickel supply and demand balance
More than enough nickel units are going around

'000 tonnes	2022	2023	2024	2025	2026
Global production	3,220	3,617	3,980	4,230	4,501
YoY change	16.2%	12.3%	10.0%	10.5%	10.2%
Global consumption	3,105	3,334	3,549	3,943	4,227
YoY change	0.4%	7.4%	6.4%	9.4%	6.5%
Balance, incl. NPI oversupply	**114**	**283**	**431**	**288**	**274**
Market inventories	506	789	1,220	1,508	1,781
Weeks of world demand	8.5	12.3	17.9	19.9	0.0
LME price ($/t)	**25,707**	**21,786**	**18,750**	**20,000**	**20,000**
LME price (c/lb)	**1,166**	**988**	**851**	**907**	**907**

Source: SNL, Woodmac, CRU, Bloomberg, company reports, INSG, BofA Global Research

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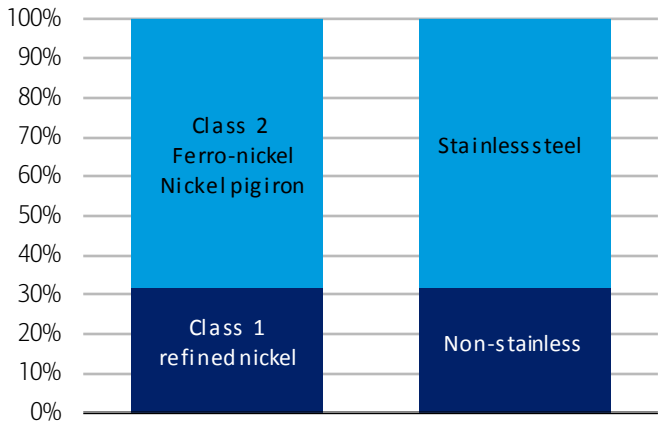
Nickel market is increasingly complex

Modelling the nickel market has always been a bit trickier than analysing the other base metals, largely because it's not just refined nickel that is traded, but also compounds and alloys. That said, there have historically been two key sectors for demand (stainless steel/non-stainless steel) and two key products (Class 2 non-refined ferronickel/nickel pig iron (NPI) and Class 1 LME-traded refined nickel). In the decade after 2001 when China industrialised, many of the consuming sectors were relatively mature, i.e. they expanded at a steady and sometimes anaemic pace. That generally made it possible to take a view on nickel fundamentals with a market balance that aggregated all the different demand sources and production routes into a single line.

Exhibit 199: Traditional breakdown of nickel supply and demand
Stainless steel mills and non-stainless steel consumers split the market between themselves



Source: CRU, Woodmac, company reports, BofA Global Research

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Exhibit 200: Nickel product breakdown and key consumers
Nickel sulphate is making an entry into the nickel market

Nickel supply	Nickel demand
Class 2 non refined nickel	
Ferronickel	Stainless steel mills, mostly ex-China
Nickel pig iron (NPI)	Stainless steel mills, China
Class 1 refined nickel	
Refined nickel	Stainless steel mills
	Non-stainless steel consumers, eg plating
Nickel sulphate	**Battery industry**

Source: BofA Global Research

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However, as batteries for electric vehicles and energy storage have become more popular, nickel demand has been super-charged and is now growing exponentially. Indeed, nickel sulphate, a chemical, is becoming increasingly important for the sector (Exhibit 200). This dynamic has had various side effects. Most notably, perhaps, the market has become increasingly disjointed, with market balances for nickel sulphate,

refined nickel and ferronickel/NPI. These products have also been trading at varying discounts or premia (Exhibit 201 and Exhibit 202).

Exhibit 201: Physical market premium, Nangjiang Shanghai
Refined nickel premia have been elevated

Source Bloomberg, BofA Global Research

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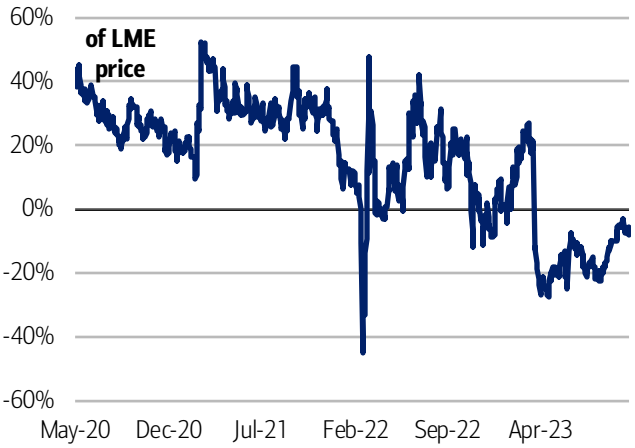
Exhibit 202: Nickel sulphate, of LME prices
Nickel sulphate has been trading at a discount to refined nickel



Source: Bloomberg, BofA Global Research

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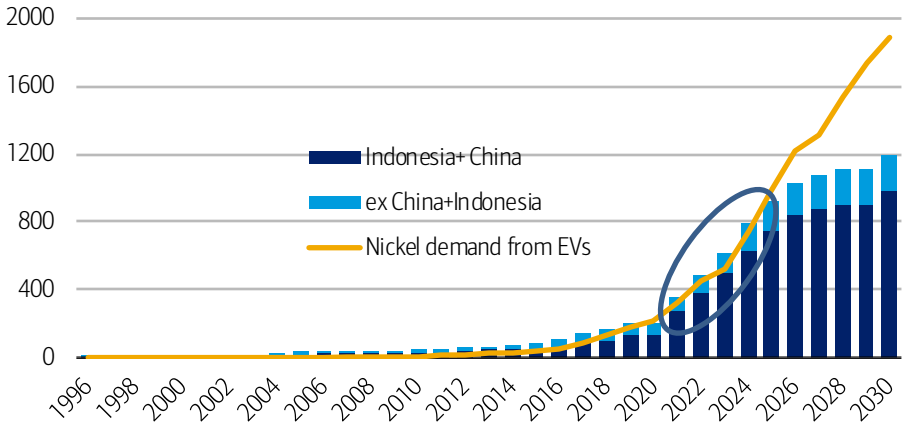
Production of nickel chemicals in China/Indonesia pushing higher

Matching supply with demand is no easy feat in a rapidly expanding market. Yet China's metals producers have been at the forefront of ensuring that nickel is not a constraint on EV manufacturing, predominantly by investing upstream in Indonesian mining and downstream into processing in China. The following chart picks up on this, showing that output increases in those two Asian countries alone would have been enough to feed global nickel demand from the auto industry (of course, nickel sulphate is also produced in other countries).

Exhibit 203: Supply of nickel chemicals versus nickel demand from EV batteries
Supply from China and Indonesia could cover total global nickel demand



Source: CRU, Woodmac, company reports, BofA Global Research

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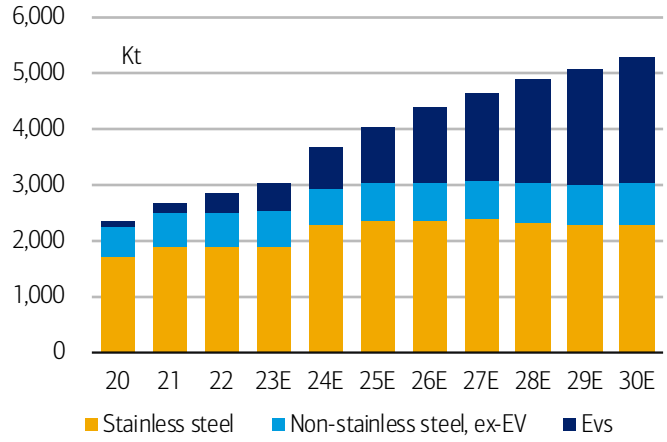
EVs to remain the marginal nickel demand drivers

Exhibit 204 takes this a step further, capturing the breakdown of nickel demand by sector, highlighting that offtake from traditional nickel users is set to remain relatively stable, while purchases from electric vehicle manufacturers are rising sharply. Meanwhile, Exhibit 205 looks at the supply side, outlining that chemicals output and recycled scrap from EVs are the marginal drivers, although nickel pig iron output is also increasing.

Exhibit 204: Nickel demand by major sector
Nickel demand growth is increasingly driven by EVs



Source: CRU, Woodmac, company reports, BofA Global Research

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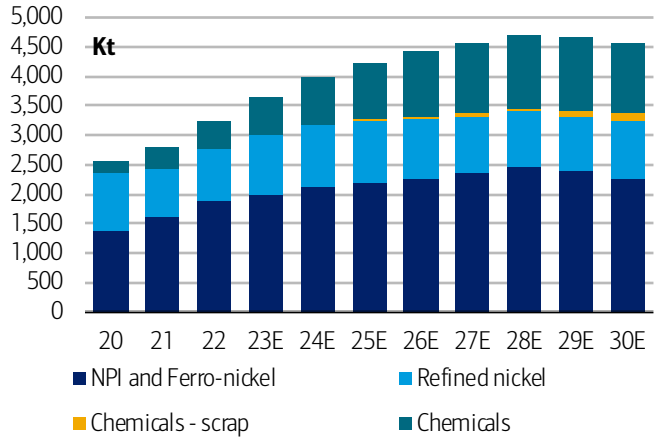
Exhibit 205: Nickel supply by product
Chemicals are making inroads into nickel supply



Source: CRU, Woodmac, company reports, BofA Global Research

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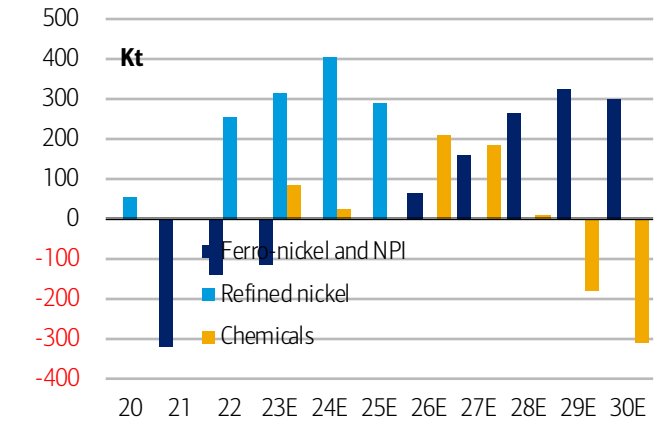
Chemicals balances deteriorate rapidly beyond 2026

Exhibit 206 squares off nickel demand with supply, confirming that the nickel market has been well supplied in recent years across all three products and we expect a market surplus also in 2024, likely keeping a lid on prices. Indeed, the projected surplus is so large that nickel should trade around marginal costs.

Further out, and acknowledging the exponential demand growth from chemicals, there is a risk that deficits will re-emerge, unless operators repeat what they have done in recent years, i.e. output needs to increase at breakneck speed. This analysis makes a range of assumptions, including:

- Nickel units are fungible, i.e tonnages can be converted between refined nickel, nickel sulphate and ferronickel/ NPI
- Any refined nickel surpluses are reallocated to chemicals first and then NPI/FeNi second, as long as those products are undersupplied

Exhibit 206: Nickel market balances by major product
Producers need to accelerate investment in chemicals



This analysis makes a range of assumptions; for instance, we assume that any refined nickel surpluses are re-allocated to chemicals first and then NPI/ FeNi second, as long as those products are undersupplied.

Source: CRU, Woodmac, company reports, BofA Global Research

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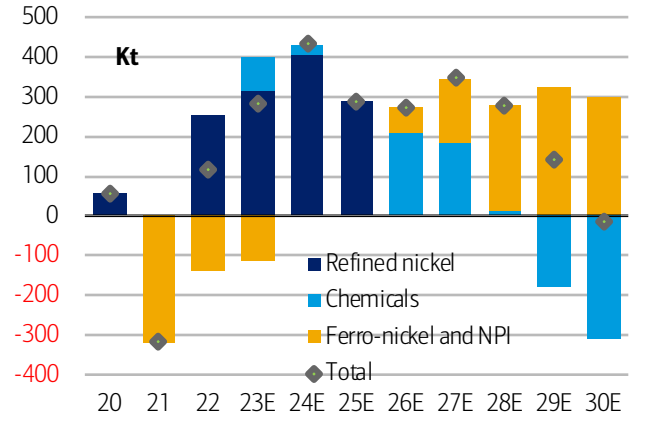
Exhibit 207: Aggregate nickel market balances
Unless more investment in chemicals comes through, the nickel market will switch into deficit



This analysis makes a range of assumptions; for instance, we assume that any refined nickel surpluses are re-allocated to chemicals first and then NPI/ FeNi second, as long as those products are undersupplied.

Source: CRU, Woodmac, company reports, BofA Global Research

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3.4 Zinc

Overview

Zinc prices have come under pressure on both supply increases and subdued demand as steel mills curtailed output. While a rebound of activity in the steel industry should support zinc, the mine project pipeline looks relatively well filled, likely preventing deficits in the coming years. Against this backdrop, and while mines have already been shuttered, zinc prices will likely trade at marginal costs without more meaningful supply cuts. Cost inflation has pushed price support higher.

Exhibit 208: Zinc supply and demand balance
Production cuts are necessary

	2022	2023	2024	2025	2026
Global production	13,919	14,000	15,150	15,900	16,150
YoY change	-2.8%	0.6%	8.2%	5.0%	1.6%
Global consumption	13,607	13,513	14,104	14,400	14,703
YoY change	-3.2%	-0.7%	4.4%	2.1%	2.1%
Balance	**312**	**487**	**1,046**	**1,500**	**1,447**
Market inventories	3,482	2,648	2,375	2,250	2,424
Weeks of world demand	13.3	10.2	8.8	8.1	8.6
LME Cash ($/t)	**3,482**	**2,648**	**2,375**	**2,250**	**2,424**
LME Cash (c/lb)	**158**	**120**	**108**	**102**	**110**

Source: SNL, Woodmac, CRU, Bloomberg, company reports, ILZSG, BofA Global Research

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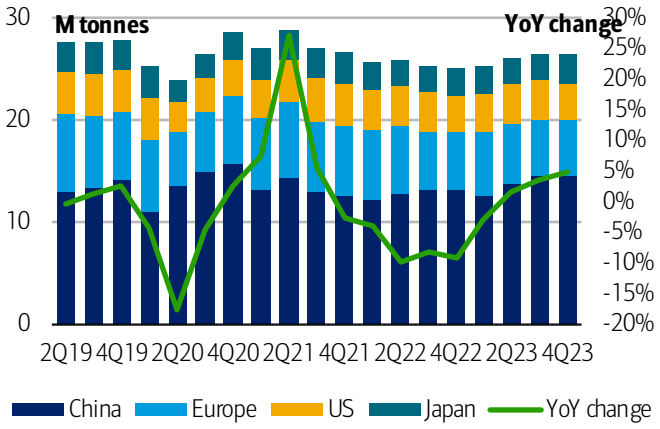
Demand has been challenged by softening construction

Global galvanized steel production has remained well below the multi-year highs that we saw immediately in the wake of the Covid pandemic (Exhibit 209). One notable driver of this weakness in production has been softening construction activity. At the same time, market participants have run down inventories through the supply chain (Exhibit 210).

Exhibit 209: Galvanised steel production
Global galvanised steel production remains below the recent highs



Source: CRU, BofA Global Research

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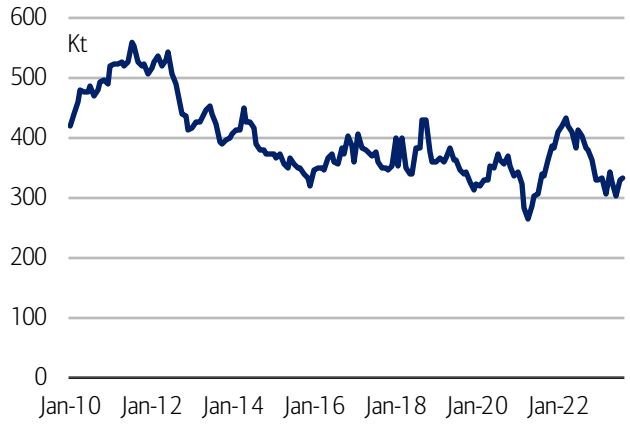
Exhibit 210: Germany, inventories of coated steel sheet
Inventories are close to multi-year lows



Source: CRU, BofA Global Research

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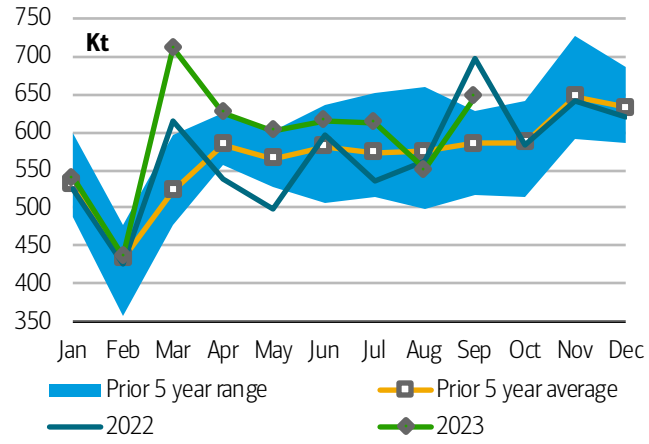
China's demand has held up overall

That said, Exhibit 209 also shows that galvanised steel production in China has been holding up. Exhibit 211 looks at this from a different angle, confirming that the country's apparent demand (refined production + imports – exports + stock changes) has been expanding YoY YTD. Exhibit 212 takes this a step further, framing contributions to demand growth by sector. The data highlights that transportation along with wider fixed asset investment activity (i.e. ex-housing) have been the key drivers behind zinc purchases.

Exhibit 211: China, apparent demand
Demand has risen YoY



Source: Bloomberg, BofA Global Research

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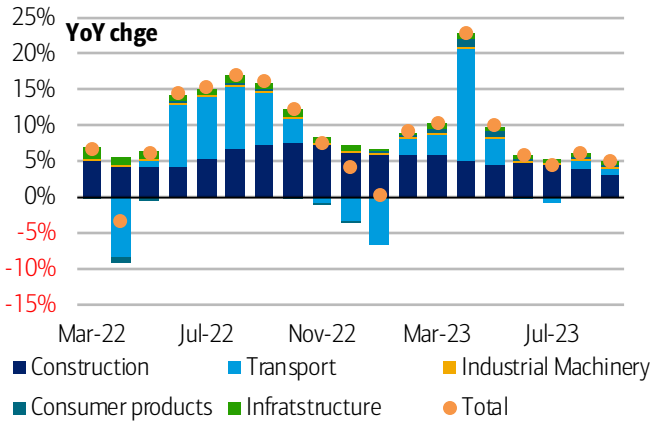
Exhibit 212: China, underlying zinc demand by sector
Zinc demand has been resilient



Source: Bloomberg, BofA Global Research

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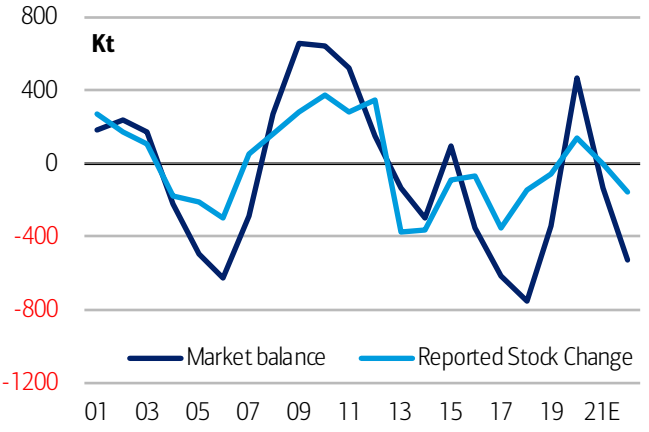
Supply is tight: in deficit for most of the past 10 years

The lack of immediate surpluses on the physical market has also been influenced by subdued supply growth in recent years. Exhibit 213 highlights that the zinc market has been in deficit for the best part of 10 years, although this may start to change now.

Exhibit 213: Zinc, refined market balances and inventory changes
The zinc market has been in deficit for almost a decade



Source: company reports, CRU, Woodmac, Bloomberg, BofA Global Research

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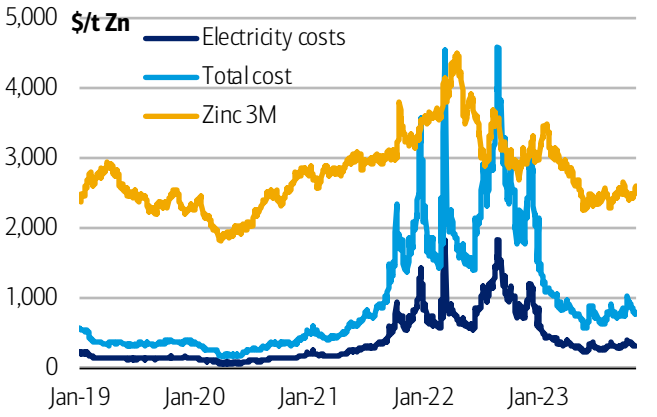
Exhibit 214: Europe, cash production costs
The energy crisis has put enormous pressure on Europe's operators, assuming electricity accounts for 40% of total cash production costs



Note: **charts assumes that electricity accounts for 40% of production costs**
Source: Bloomberg, BofA Global Research

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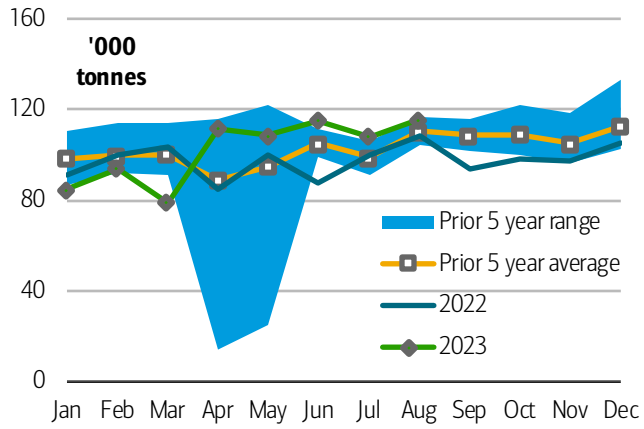
Indeed, Production curbs have been driven by a range of idiosyncratic dynamics, which are starting to normalise, including:

- Smelters in Europe have been under pressure from high electricity costs in 2022 (Exhibit 214). While the region has emerged from the worst of the energy crisis, production has remained subdued. To that end, Glencore and Nyrstar have shuttered their 130kt Portovesme and 290Kt Budel smelters in Italy and the Netherlands, respectively.

- At the same time, mine production had been under pressure – perhaps most visibly in Peru, where unrest pushed output to multi-year lows in recent months (Exhibit 215), although supply has since recovered.

Exhibit 215: Peru, zinc mine production
Peru's zinc production is recovering



Source: Bloomberg, BofA Global Research

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Exhibit 216: Spot treatment charges
Treatment charges are off the lows

Source: S&P, Woodmac, CRU, Bloomberg, company reports, ILZSG, BofA Global Research

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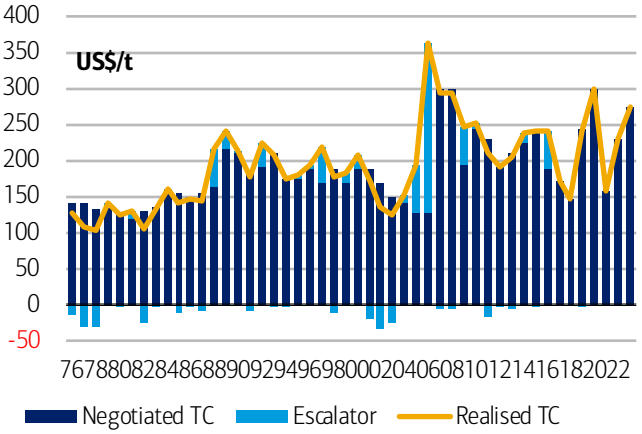
Incidentally, a better-supplied zinc market can already be detected in treatment charges[1], which are off the lows. Against this soft fundamental backdrop, we note that around 20% of zinc mines have not been profitable of late (Exhibit 218). This has already led to a series of production curtailments, suggesting that prices should be supported above $2,200/t ($1/lb). Looking at this from a different angle: another round of cutbacks could help and if those ultimately rebalanced the zinc market, this would make us more constructive.

Exhibit 217: Contract treatment charges
Contract treatment charges are also off the lows, suggesting an improved availability



Source: S&P, Woodmac, CRU, Bloomberg, company reports, ILZSG, BofA Global Research

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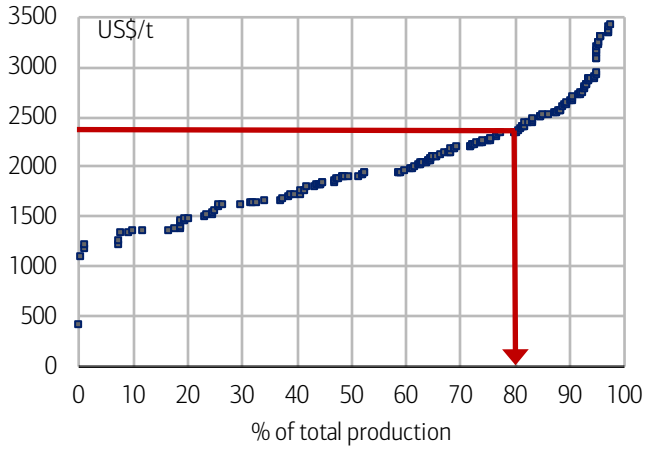
Exhibit 218: Zinc cost curve
With zinc trading averaging $2,400/t ($1.08/lb) in the past six months, around 20% of zinc mines have not been profitable



Source: S&P, BofA Global Research

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[1] Mines send zinc concentrates to smelters. Smelters receive a treatment charge (TC) from the miners for their services, while miners retain the zinc price less the treatment charge. TCs are an important indicator for constraints: when they fall, concentrates availability is insufficient. Hence, there are two zinc market balances: one for concentrates, the other for refined metal

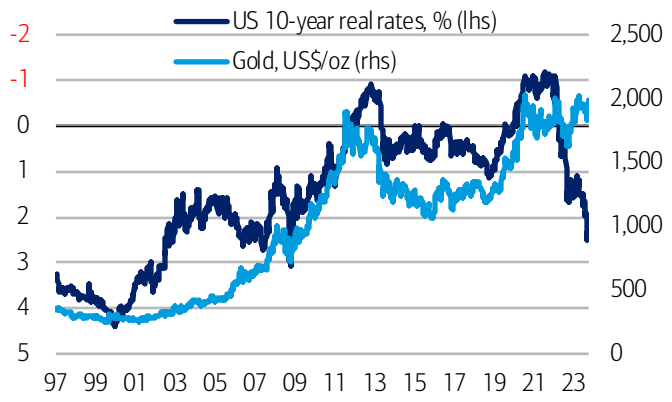
4. Precious metals

4.1 Gold

Overview

Gold prices have held up against the backdrop of sharply higher US rates in recent weeks. Exhibit 219 highlights that a visible gap has opened up between the assets – a development market participants are increasingly picking up on. While we acknowledge the dislocation, that chart comes with a significant caveat: Exhibit 220 shows that our traditional gold price model, which runs on US 10-year real rates and the dollar, continues to perform well. How can that be justified? That model factors in changes of gold prices, rates and the USD, not levels. The bottom line: rates and USD matter, with changes in direction more important than the actual levels. As such, the next leg higher will come when the Fed cuts rate, likely in 2024.

Exhibit 219: US, 10-year rates and gold prices
Gold has been resilient against a backdrop of sharply higher US rates



Source: Bloomberg, BofA Global Research

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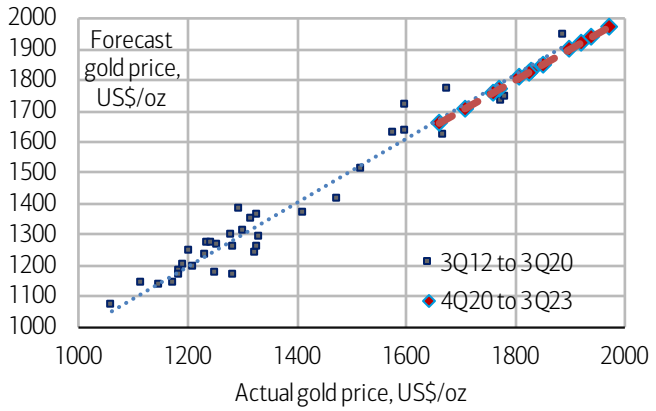
Exhibit 220: Gold price estimates
Changes in US rates and USD explain most of the gold price movements



Source: Bloomberg, BofA Global Research

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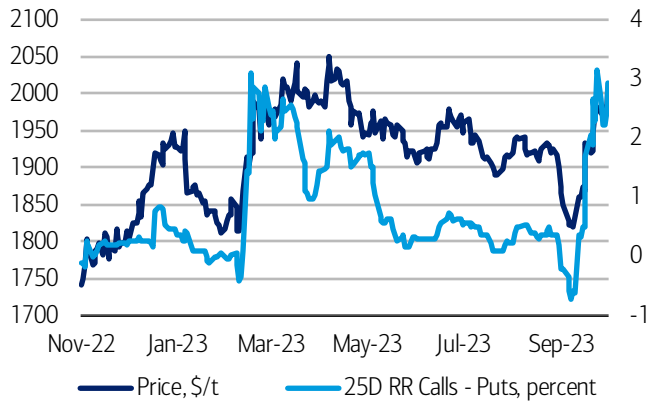
Geopolitics matters, but rates remain key

Of late, gold has rallied as the conflict between Hamas and Israel has escalated. The repricing of gold has been particularly visible in the options space, with risk reversals pushing visibly higher, confirming top-side buying. Not surprisingly, these purchases of optionality have been accompanied by rising vols.

Exhibit 221: Gold prices and risk reversals
Risk reversals have repriced substantially



Source: Bloomberg, BofA Global Research

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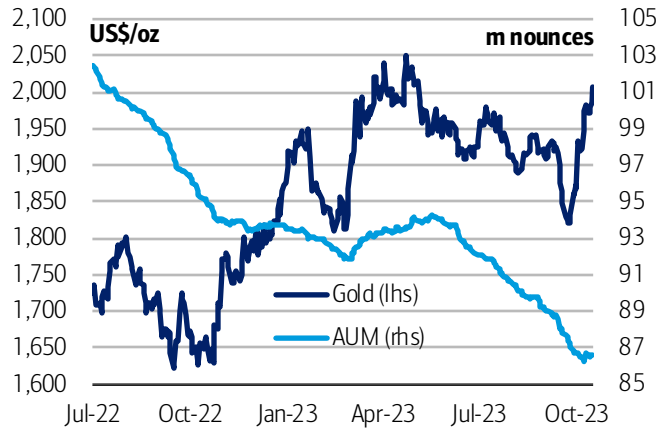
Exhibit 222: Gold and AUMs at physically backed ETFs
ETF outflows have subsided



Source: Bloomberg, BofA Global Research

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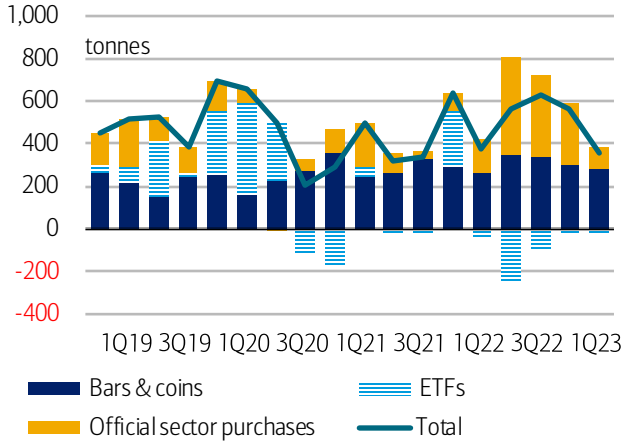
That said, pure directional position-taking has been much more muted. Aggregate investor purchases, visible in faltering demand for physical gold ETFs, remain well below the levels seen since the onset of the Covid pandemic.

Exhibit 223: Gold, investor demand
Physical non-commercial purchases remain well below recent highs



Source: World Gold Council, BofA Global Research

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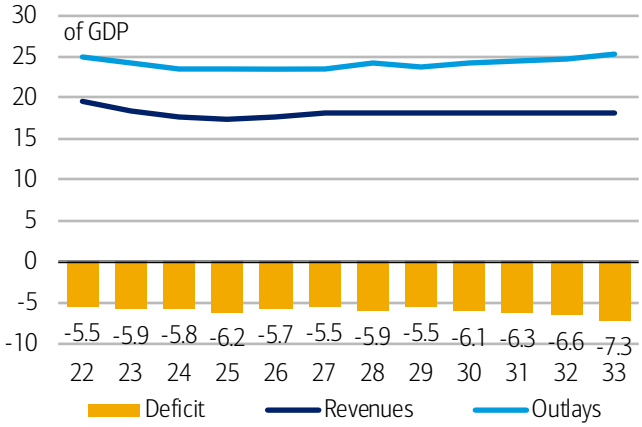
Exhibit 224: US public finances
Congressional Budget Office expects the deficit to increase



Source: Congressional Budget Office, BofA Global Research

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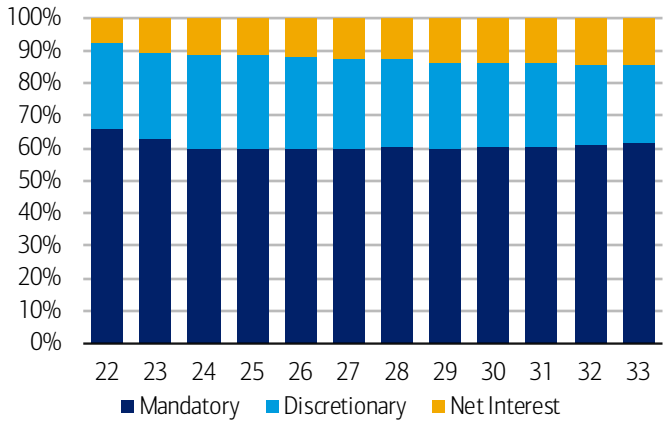
In our view, this confirms that, beyond an oil-related price spike, the next sustained leg higher in gold prices is unlikely to come until rates start falling.

Wars intensify as fiscal firepower falls

Taking a closer look at the macro backdrop, the US economy is slowing and Europe is barely managing to stay out of recession. Accordingly, the possible causes of the recent rally in US rates, which was accompanied by falls in wider metals prices have been much discussed. We would caution that the bond vigilantes have come out in force. In fact, we believe rates have pushed higher since the market had been repricing the Fed rate path. That said, fiscal policy remains a concern. The IMF highlighted that "Faced with myriad spending pressures, political red lines limiting taxation at an insufficient level translate directly into larger deficits that push debt to ever-rising heights. Something must give to balance the fiscal equation. Policy ambitions may be scaled down or political red lines on taxation moved if financial stability is to prevail".

Exhibit 225: US, public spending
The bulk of US public spending is non-discretionary



Source: Congressional Budget Office, BofA Global Research

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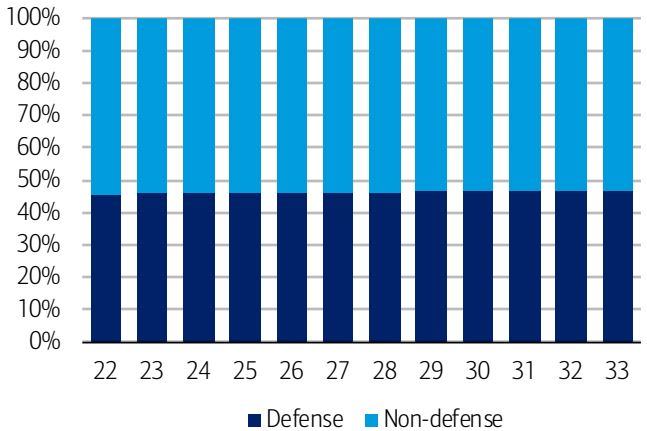
Exhibit 226: US, public discretionary spending
Defense is a significant line item in discretionary spending



Source: Congressional Budget Office, BofA Global Research

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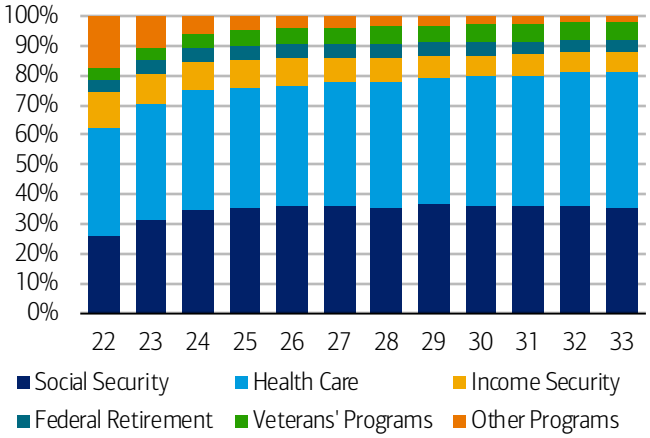
Exhibit 224 shows the US Congressional Budget Office's (CBO) expectation that fiscal deficits could rise above 7% by 2033. Exhibit 225 digs a bit deeper, outlining that this will be accompanied by a squeeze on **discretionary spending** from interest payments and mandatory expenditure. Meanwhile, Exhibit 226 shows that defense accounts for almost half of discretionary spending. As to **mandatory spending**, Exhibit 227 outlines that most of it is deployed on social security and health care, politically difficult to tackle. All of this matters because:

- Recent policy rate increases are starting to feed through into the economy. Keeping in mind high public debt and net interest payments, there is a case to be made for the Fed to lower interest rates. Lower rates, accompanied by a weaker dollar, are supportive of gold.
- The dynamic around defense spending is also important, considering that the number of countries engaged in armed conflicts has risen to a record high (Exhibit 228). This is why Tudor's Paul Tudor Jones has suggested that we are going through "the most threatening and challenging geopolitical environment that I've ever seen," which is occurring "at the same time the United States is at its weakest fiscal position since World War 2." He added that gold (and Bitcoin) should "probably take on a larger percentage of your portfolio than historically".

Exhibit 227: US, public non-discretionary spending

Entitlements make up the bulk of public spending



Source: Congressional Budget Office, BofA Global Research

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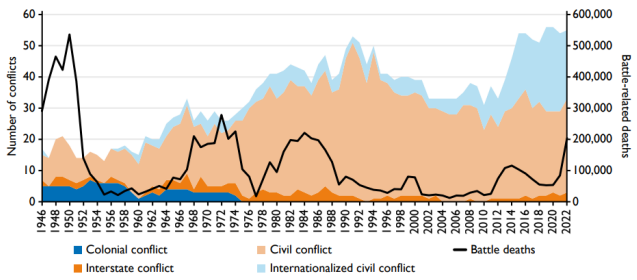
Exhibit 228: Number of countries with state-based armed conflicts by conflict type, 1946–2022

The world has always been an insecure place, but it has become even more so lately



Source: Lacina & Gleditsch Battle Death Dataset (2005); UCDP/PRIO Armed Conflict Dataset; UCDP Battle-Related Deaths Dataset (Davies et al., forthcoming)

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Oil at $150/bbl = gold at $2,400/oz

While the relationship between gold and wars has not always been straightforward, we would caution against discounting the turmoil in the Middle East entirely. Indeed, the concept of "energy fragility" has again reared its head. We recently outlined four scenarios for the oil market, expecting prices to hit $150/bbl or higher if a broadening regional conflict resulted in damage to Middle East energy infrastructure. All else equal, gold could rally to $2,400/oz if this known unknown came to pass. Of course, beyond higher oil prices, the yellow metal would also be impacted by rates, which would in all likelihood fall initially on a flight to quality. However, this may ultimately reverse over fears of increased inflation and fiscal spending.

4.2 Silver

Overview

While silver has found a floor above $20/oz, prices have not been able to push higher, despite production discipline from the miners and rising demand from green technologies. This has been heavily influenced by weak industrial production and a lack of investor interest globally. However, if the continued focus on the energy transition is accompanied by stronger global growth, silver prices should push higher.

Exhibit 229: Silver supply and demand balance
The silver market has been better supplied this year on ETF outflows

tonnes	2022	2023	2024	2025	2026
Global production	31,244	31,874	31,459	31,272	28,890
YoY change	0.0%	2.0%	-1.3%	-0.6%	-7.6%
Global consumption	33,137	34,961	35,498	35,663	35,603
YoY change	-0	5.5%	1.5%	0.5%	-0.2%
Balance	**-1,893**	**-3,087**	**-4,039**	**-4,391**	**-6,713**
Spot ($/oz)	21.8	23.2	23.3	24.8	26.1

Source: Silver Institute, company reports, BofA Global Research

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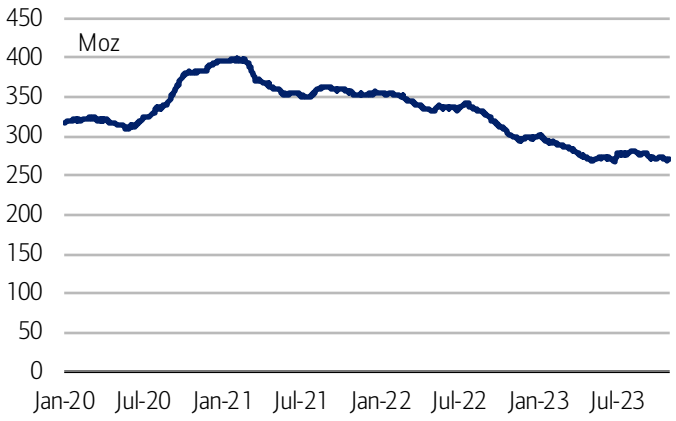
Inventories at CME and LBMA warehouses have fallen

Silver prices have been supported by supportive fundamentals. Granted, silver is often traded over-the-counter (OTC), reducing visibility somewhat. But it is worth noting that above-ground-stocks, especially at storage sites linked to the Chicago Mercantile Exchange (CME) and London Bullion Market Association (LBMA), have fallen steadily (Exhibit 230).

Exhibit 230: CME silver inventories
Silver stocks have been falling



Source: Bloomberg, BofA Global Research

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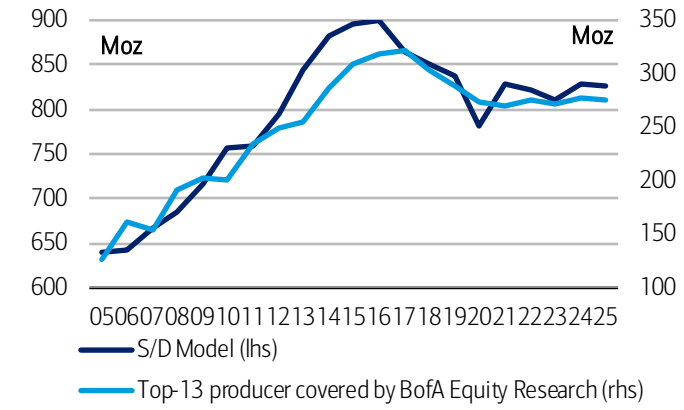
Exhibit 231: Silver production
Guidance from the largest silver producers suggests that silver output will not return to previous highs any time soon



Source: Bloomberg, Silver Institute, BofA Global Research

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Mine supply remains well below all-time highs

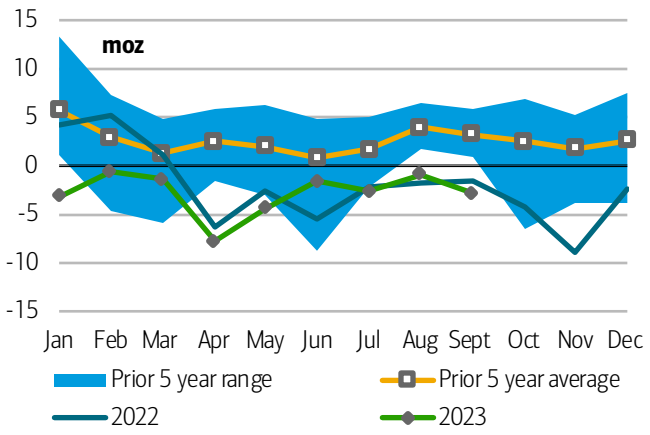
Supportive fundamentals have been driven by both supply and demand dynamics. We usually focus on the following line items:

- **Mine supply**: in contrast to gold, a much larger share of silver production is consumed, rather than put into storage. This means that, similar to the base metals, prices of the white metal tend to be driven by market balances.
- **Traditional industrial demand**: industrial users have been the mainstay of the silver consumption and buying is often linked to the strength of economic growth. Indeed, silver tends to outperform gold when industrial activity accelerates.

- **Green silver demand** is becoming more important as the white metal is used heavily in high-end electronics applications.

Looking into mine supply first, sustained silver price declines 10 years ago ultimately prompted production cuts. These curtailments have helped to rebalance the market, laying the foundations for the price increases thereafter. Exhibit 231 takes this a step further, comparing silver production from the miners covered by our colleagues in equity research with total output. The data suggests that supply is set to remain subdued. This is also linked to CAPEX discipline in recent years. In the end, the message is always the same: no investment, no production.

Exhibit 232: China, net silver imports
China has been a net silver exporter



Source: Bloomberg, BofA Global Research

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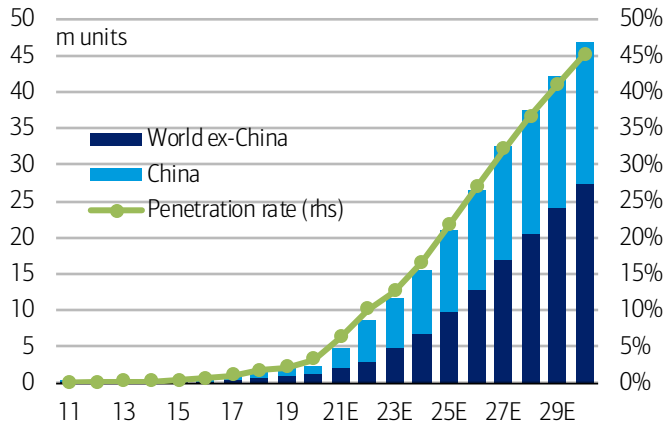
Exhibit 233: Global EV production and penetration rates
EV penetration rates are set to rise above 40% by 2030



Source: Bloomberg, BofA Global Research

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Silver demand from traditional sectors subdued

Industrial demand has been weak amid Covid disruptions and rate hikes

Switching to demand, silver usage from the traditional industrial users has been subdued amid economic dislocations from Covid. This carried over into 2023. Indeed, silver imports from many countries are still at disappointingly low levels. Silver purchases from Japan and the US have been hovering at the lower end of the historical ranges. The picture has been similar in China, which has remained a small net exporter of silver in recent months, as Exhibit 232 highlights.

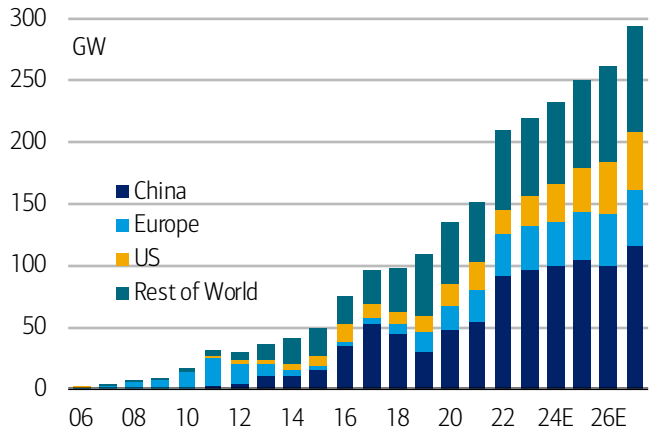
Meanwhile, India has been a bright spot in silver purchases in the past year, purchasing record volumes of the precious metal over the summer. Among other things, this reflected pent-up demand especially for jewellery post Covid, which was then exacerbated by restocking through the entire supply chain. That said, imports have returned to longer-term ranges of late.

Offtake from green sectors set to increase

In green sectors, i.e. electric vehicles and renewables, rising demand should support silver prices going forward. Exhibit 233 highlights that electric vehicle production is set to increase steadily in the coming years and EV penetration rates should rise above 40% by 2030 in our base case.

Meanwhile, Exhibit 234 highlights that solar installations around the world are also increasing. While this is supportive of silver offtake, there are caveats because panel manufacturers have been 1) reducing the silver content in panels (this may reverse in the next generation of PV, see Metals Strategist: Tech goes metals 06 October 2023), at the same time as 2) solar panels have become more efficient, so fewer installations are necessary. Exhibit 235 picks up on this, suggesting silver demand will stabilise at elevated levels.

Exhibit 234: Solar installations
PV installations are increasing steadily



Source: IEA, BofA Global Research estimates

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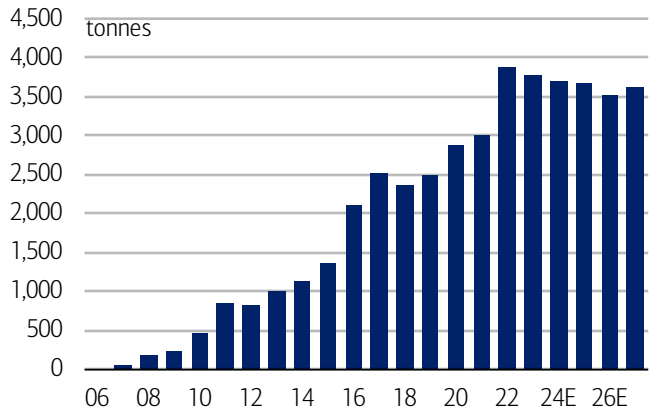
Exhibit 235: Silver demand from solar panels
Silver demand is set to stabilise at elevated levels



Source: IEA, Silver Institute, BofA Global Research estimates

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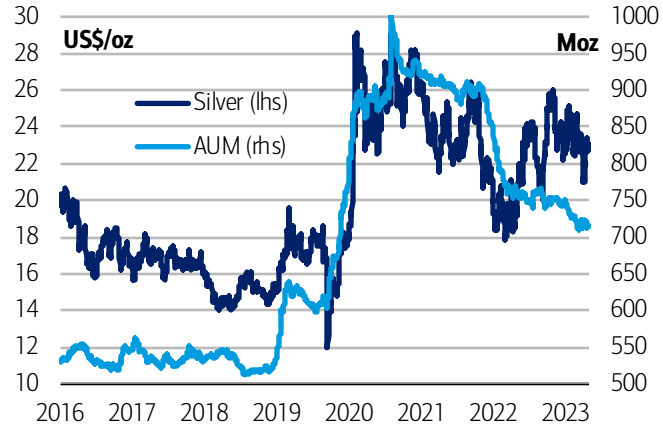
As such, aggregate silver purchases from the green economy will likely trend higher in the coming years, accounting for 22% of total silver demand by 2030E, from 18% in 2022.

Investors still on the sidelines

Physically backed ETFs have made it easy for consumers to access the silver market. Not surprisingly, these vehicles hold 748moz of assets, equivalent to around 88% of metal held in LBMA warehouses. Linked to that, Investors have often been the marginal price drivers. Yet confidence in the white metal took a hit in the past decade as bullish pitches around "promising" applications, like usage in medical bandages, never really materialised. That said, production cuts, along with increased demand from EVs and solar panels, have rebalanced the silver market, so prices are now finding support, even without non-commercial demand.

To that point, assets under management as physically backed ETFs have been declining since 3Q22. Yet with fundamentals strengthening, there is scope for increased investor buying, which may then provide additional momentum to silver prices.

Exhibit 236: Silver, assets under management at ETFs and prices
AUMs at physically backed ETFs have fallen persistently



Source: Bloomberg, BofA Global Research

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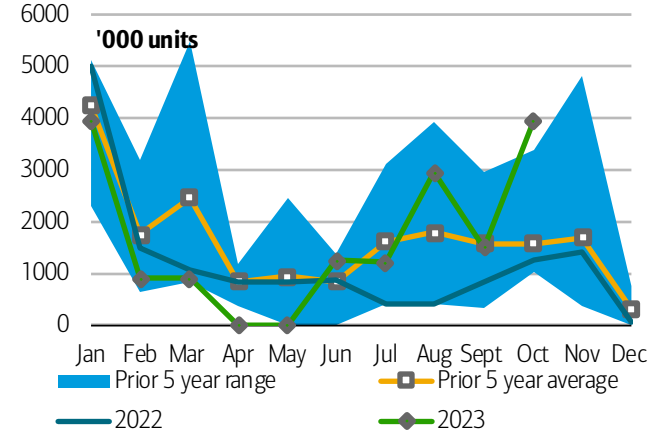
Exhibit 237: US, Silver Eagle coin sales
Coin sales have been volatile, but have generally remained within recent ranges



Source: Bloomberg, BofA Global Research

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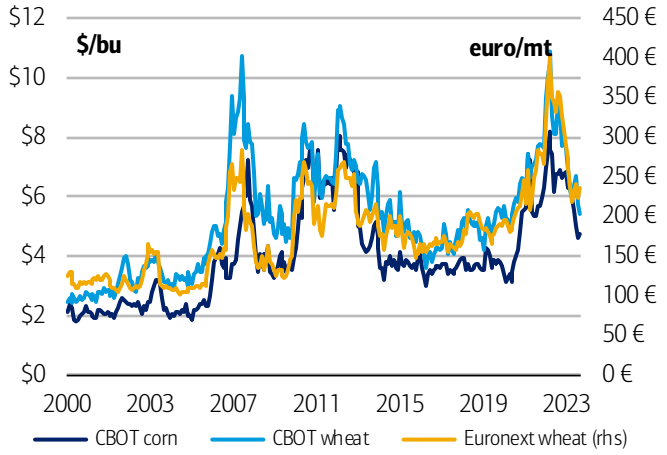
5. Agriculture outlook

Global grain and oilseed prices have retreated from 2022 highs...

Grain and oilseed markets have given back nearly all their gains stemming from the war in Ukraine and its potential to curb production and exports from the Black Sea region. Indeed, CBOT corn and wheat are down 42% and 45% from end of April 2022 levels and recently traded to the lowest levels since the end of 2020 (Exhibit 238). Oilseeds have mostly held up better, with CBOT soybeans and SAFEX sunflower seed falling roughly 20% over the same period. That said, Euronext rapeseed prices have collapsed 55% since April 2022 (Exhibit 239).

Exhibit 238: Global grain prices
CBOT corn and wheat are down 42% and 45% from end of April 2022 levels and recently traded to the lowest levels since the end of 2020



Source: Bloomberg

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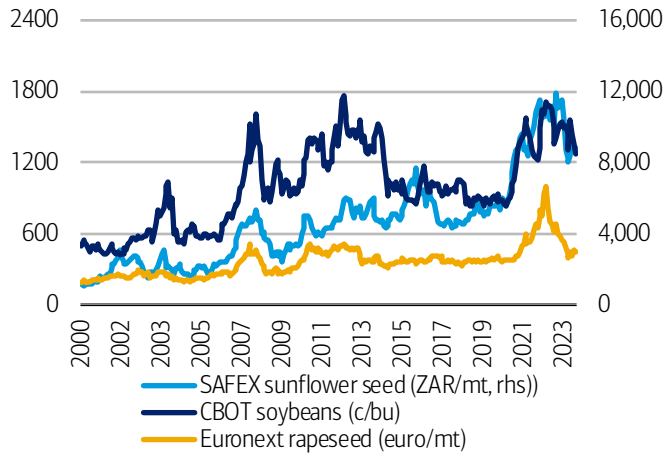
Exhibit 239: Global oilseed prices
Oilseeds have mostly held up better, with CBOT soybeans and SAFEX sunflower seed falling roughly 20% over the same period



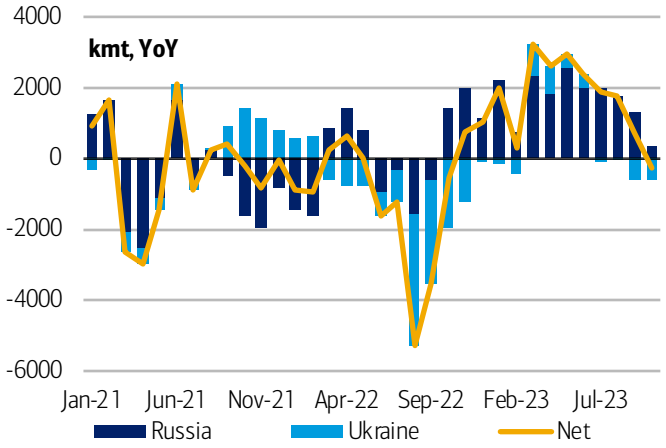
Source: Bloomberg

BofA GLOBAL RESEARCH

...as war in Ukraine failed to meaningfully tighten balances...

Potential fallout from war in Ukraine was the one of the biggest uncertainties the agriculture markets faced in a long time. Expectations for a significant reduction in Ukraine crops and exports drove wheat prices to record levels and corn and soybean prices within reach of their 2012 records. Export estimates did show a significant drop in waterborne wheat exports from Russia and the Ukraine during 2H22, but shipments have largely rebounded since then (Exhibit 240). Meanwhile, global supplies of wheat rose during 2022/23, but corn and sunflower crops came in slightly lower (Exhibit 241). Overall, crops are set to rise across many major grains and oilseeds from 2021/22 to 2023/24, suggesting that any damage to Black Sea crops has been offset by larger crops elsewhere.

Exhibit 240: Russia and Ukraine seaborne wheat exports
Export estimates did show a significant drop in waterborne wheat exports from Russia and the Ukraine during 2H22, but shipments have largely rebounded since then



Source: USDA

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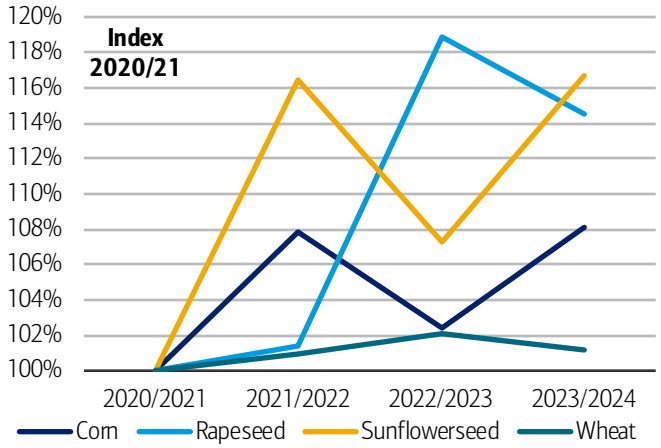
Exhibit 241: Global production by crop
Overall, crops are set to rise across many major grains and oilseeds from 2021/22 to 2023/24, suggesting that any damage to Black Sea crops has been offset by larger crops elsewhere



Source: USDA

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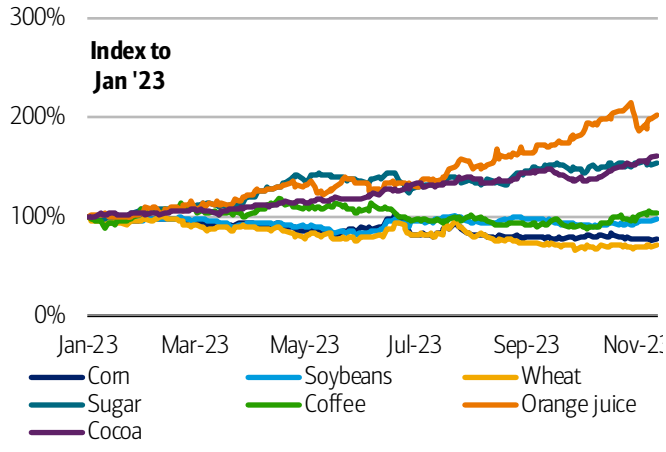
...but soft commodities and proteins have been more resilient

As grains and oilseeds mean-reverted this year, with corn, soybeans, and wheat all trading lower since the start of the year, several soft commodities have significantly outperformed (Exhibit 242). Cocoa and sugar are trending more than 50% higher than the start of the year, while orange juice prices are roughly 100% higher ytd. Weather has played a significant role in the outperformance of many soft commodities, where production is typically concentrated in tropical environments that have been hit hard by extreme weather. Proteins have also outperformed grains and oilseeds, with live cattle trading 15% higher YoY (Exhibit 243) and pork prices remaining buoyant.

Exhibit 242: Agriculture commodity price performance (active contracts)
As grains and oilseeds mean-reverted this year, with corn, soybeans, and wheat all trading lower since the start of the year, several soft commodities have significantly outperformed



Source: Bloomberg

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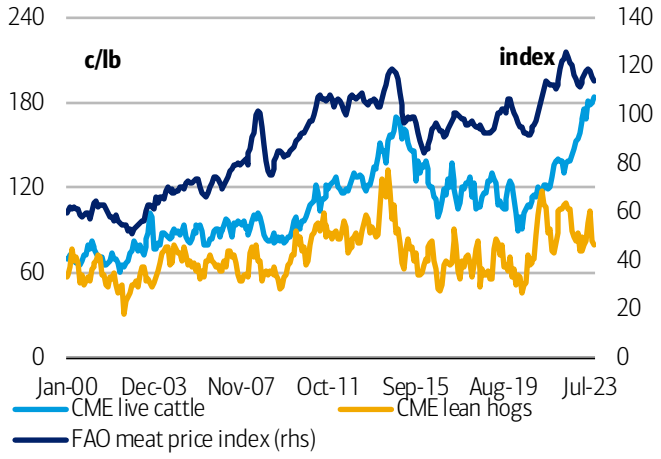
Exhibit 243: CME cattle and hog prices and the FAO meat price index
Proteins have also outperformed grains and oilseeds, with live cattle trading 15% higher YoY and pork prices remaining buoyant



Source: Bloomberg

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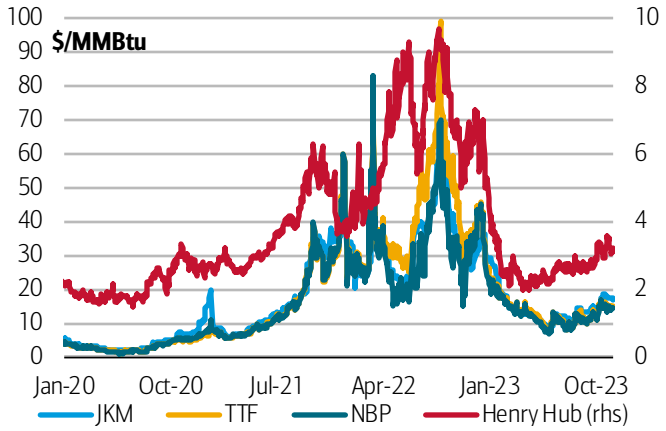
Meanwhile, the energy supply shock has eased, cutting input costs

One source of support for higher agricultural prices in 2022 came from soaring energy prices, which pushed up the cost of fertilizer and increased the cost of operating in the field due to higher diesel prices. European natural gas, which led global gas prices higher in 2022, has fallen more than 85% from the high and is down more than 35%

year to date (Exhibit 244). Falling natural gas prices have helped deflate fertilizer prices, which are higher than they have been in recent years but below levels seen in 2022 (Exhibit 245).

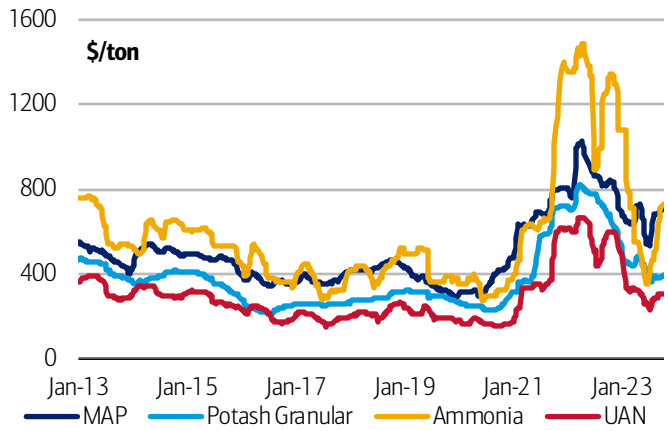
Exhibit 244: Global gas prices
European natural gas prices, which led global gas prices higher in 2022, have fallen more than 85% from the high and are down more than 35% year to date



Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 245: USGC fertilizer prices
Falling natural gas prices have helped deflate fertilizer prices, which are higher than they have been in recent years but below levels seen in 2022



Source: Bloomberg

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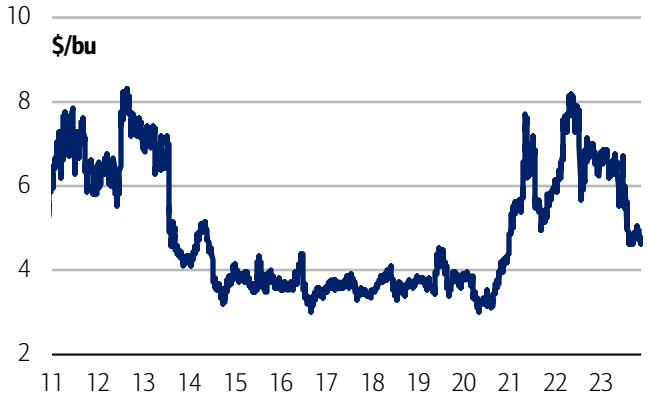
5.1 Corn

Corn prices have collapsed below $5/bu in 2023 after topping $8 in 2022…

Since the start of the pandemic, corn prices have traded a range of more than $5/bushel, reaching a low of $3 in April 2020 before trading to a high of $8.27 in May 2022 (Exhibit 246) as concerns around Ukrainian supply losses hit a fever pitch. Since then, prices have fallen more than 30%, with front month prices recently trading near $4.70/bu. As prices have come down, the forward curve for CBOT corn has shifted from steep backwardation to mild contango (Exhibit 247). Interestingly, compared to the forward curve in May, nearby prices have fallen, while 2025/26 prices have risen.

Exhibit 246: Front month CBOT corn prices
Since the start of the pandemic, corn prices have traded a range of more than $5/bushel, reaching a low of $3 in April 2020 before trading to a high of $8.27 in May 2022



Source: Bloomberg

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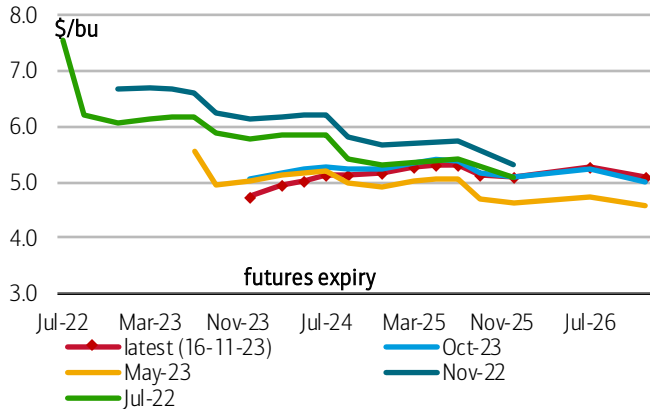
Exhibit 247: Corn Forward Curve
As prices have come down, the forward curve for CBOT corn has shifted from steep backwardation to mild contango



Source: Bloomberg

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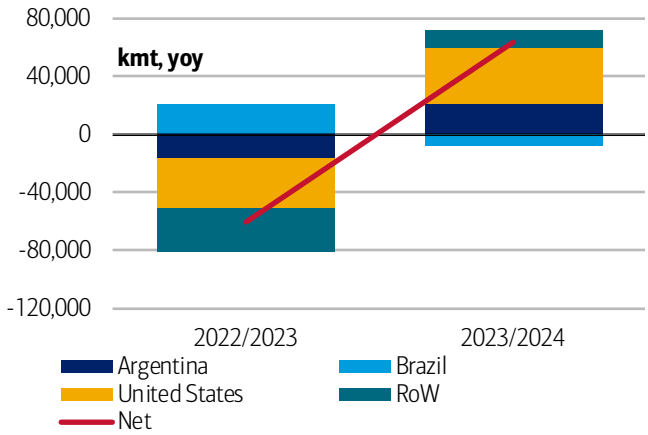
…on the back of rebounding US and Argentine corn expectations

The global corn crop dropped 60mn mt YoY during 2022/23, with the US and Argentine crops falling more than 34mn mt and 15mn mt, respectively (Exhibit 248). Forecasts for 2023/24 suggest the global crop will rebound and make a new record high, thanks in part to a record corn crop out of the US. Growth in US corn supply is likely to expected to outpace domestic demand and exports, leaving US carryout at more than 62mt mt, the highest level since 2018/19 (Exhibit 249).

Exhibit 248: Global corn supply growth
The global corn crop dropped 60mn mt YoY during 2022/23 and should rise 63mn mt YoY in 2023/24



Source: USDA

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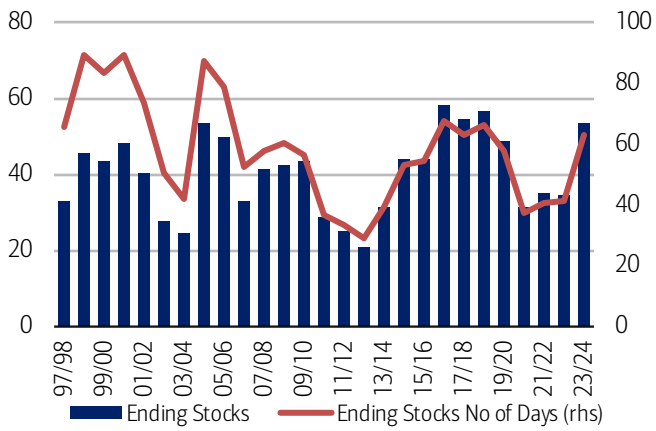
Exhibit 249: US Corn Ending Stocks
Growth in US corn supply is likely to expected to outpace domestic demand and exports, leaving US carryout at more than 62mn mt, the highest level since 2018/19



Source: USDA

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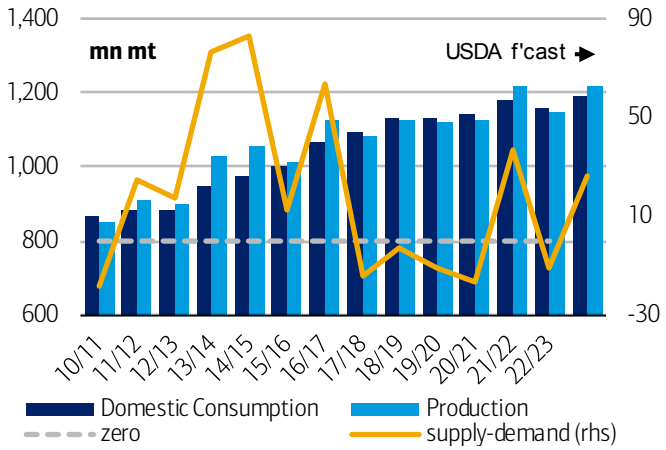
Corn ending stocks to build in 2023/24 but price risks skewed higher

A record global corn crop of 1,221mn mt is set to outpace demand growth this year, leading to a surplus of more than 26mn mt (Exhibit 250). This is set to boost global corn ending stocks to 315mn mt (Exhibit 251). This shift in balances has helped push corn prices back to earth trading at exceptionally high levels in 2022. Given recent price moves, corn's increasing attractiveness as a feed versus meal, and the expectation that farmers may hold off on selling corn at current low price levels, we see risk of prices moving higher into 2024.

Exhibit 250: Global corn supply and demand

Globally, a record global corn crop of 1,221mn mt this year is set to outpace demand growth, leading to a surplus of more than 26mn mt...



Source: USDA

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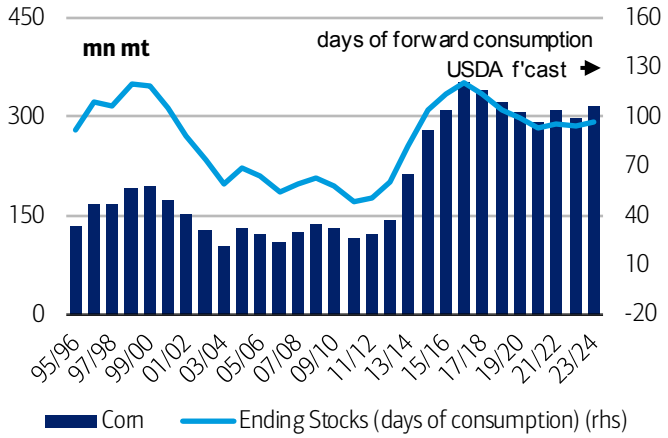
Exhibit 251: Global corn ending stocks

...which is set to boost global corn ending stocks to 315mn mt



Source: USDA

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5.2 Soybeans

Soybean prices have fallen but remain more buoyant than grains...

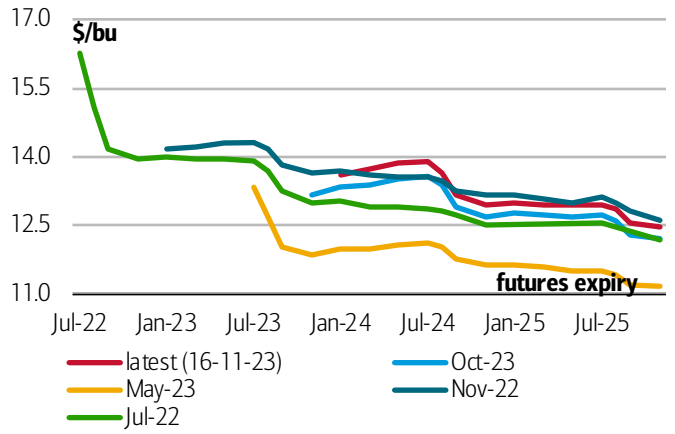
The oilseed complex has mostly held up better than the grains, with front month soybean futures falling roughly 20% from the highs of 2022 to about $13.80/bu in recent days (Exhibit 252). Even after the decline, nearby soybean prices remain historically high, rivaling the loft levels seen during the 2011-14 timeframe. The contango at the front end of the soybean forward curve has steepened in recent months, while the entire curve has shifted more than $1/bu higher since May (Exhibit 253).

Exhibit 252: US soybean front month prices
The oilseed complex has mostly held up better than the grains, with front month soybean futures falling roughly 20% from the highs of 2022 to about $13.80/bu in recent days

Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 253: Soybean forward curve
The contango at the front end of the soybean forward curve has steepened in recent months, with the entire curve also shifting more than $1/bu higher since May



Source: Bloomberg

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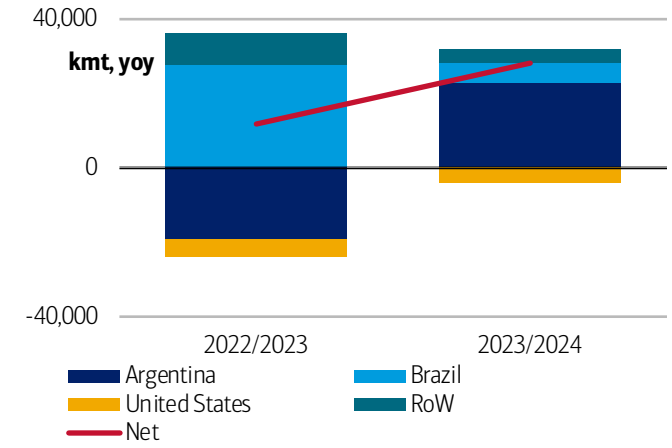
...and production continues to soar higher in the Americas

Global soybean production is set to rise for the second consecutive year in 2023/24, driven by a recovery in Argentina's crop and continued growth in Brazil (Exhibit 254). In aggregate global supply is expected to rise roughly 28mn mt YoY. If weather behaves, Brazil is expected to produce its second consecutive record crop, topping 163mn mt, while the US crop declines for the second year in a row (Exhibit 255).

Exhibit 254: Global soybean production growth
Global soybean production is set to rise for the second consecutive year in 2023/24, driven by a recovery in Argentina's crop and continued growth in Brazil



Source: USDA

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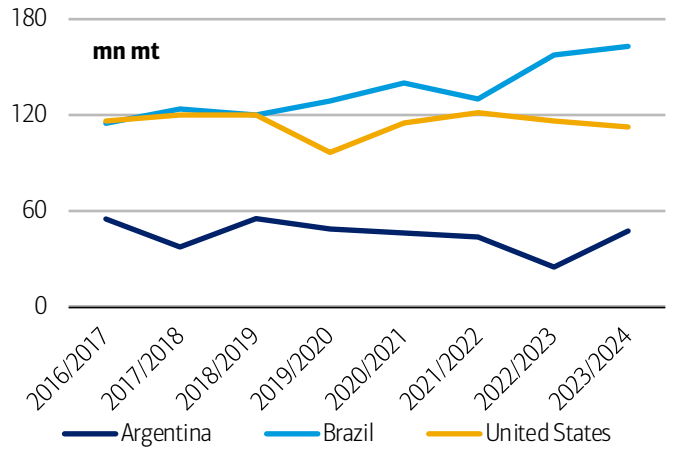
Exhibit 255: Soybean production in Brazil, Argentina, and the USA
If weather behaves, Brazil is expected to produce its second consecutive record crop, topping 163mn mt, while the US crop declines for the second year in a row



Source: USDA

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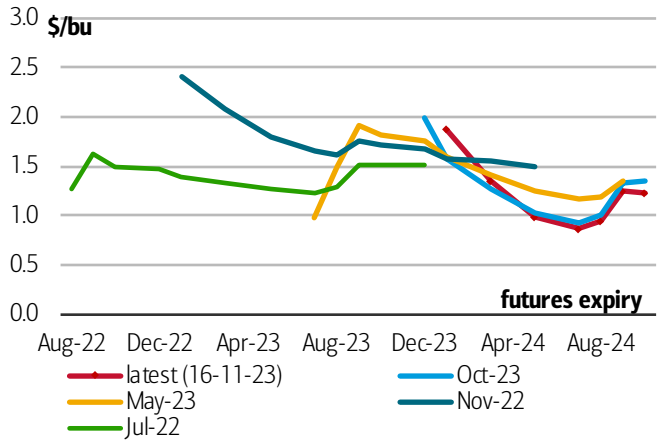
Crush margins remain historically strong, but oil's contribution lower

Soybean crush margins continue to trend at historically high levels of more than $2.50bu, more than double 10-year average levels of $1.15/bu. The front end of the crush curve continues to stay supported, but the forwards are steeply backwardated, with crush dipping below $1/bu during the summer of 2024 (Exhibit 256). Soybean oil's contribution to crush margins peaked last year at more than 50%, helped by the ramp up of renewable diesel capacity, but meal has gained ground more recently (Exhibit 257). As a result, oil's share of margins have fallen below 40%.

Exhibit 256: Soybean crush margins

The front end of the crush curve continues to stay supported but the forward curve is steeply backwardated with crush dipping below $1/bu during the summer of 2024

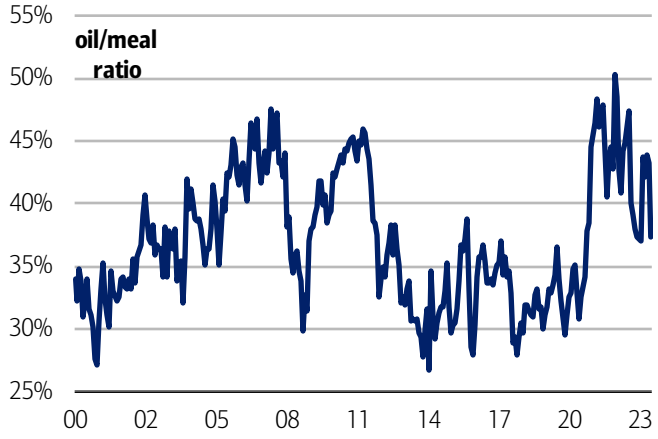


Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 257: Oil's % of soybean board crush revenue (meal+oil)

Soybean oil's contribution to crush margins peaked last year at more than 50%, helped by the ramp up of renewable diesel capacity, but meal has gained ground more recently



Source: Bloomberg, BofA Global Research

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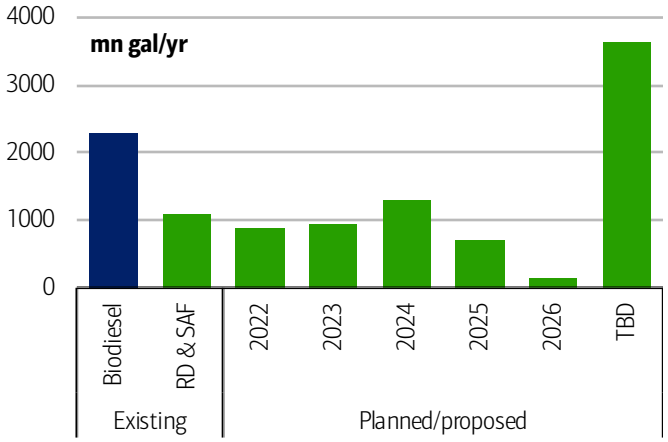
Yet, demand for oil will continue to rise into 2024 with RD capacity

The buildout of renewable diesel capacity in the US has been a key source of support for soybean and soybean oil prices. In 2022-23, renewable diesel capacity is estimated to have risen roughly 1.8bn gal/yr, and we expect capacity additions to top 1.3bn gal/yr in 2024 (Exhibit 258). These capacity additions have helped double biomass diesel supply since 2019, with some growth leveraging soybean oil as a feedstock (Exhibit 259). Interestingly, alternative feedstocks have played a more meaningful role in supply renewable diesel facilities than some in the market expected recently, which helps explain some of soybean oil's relative weakness.

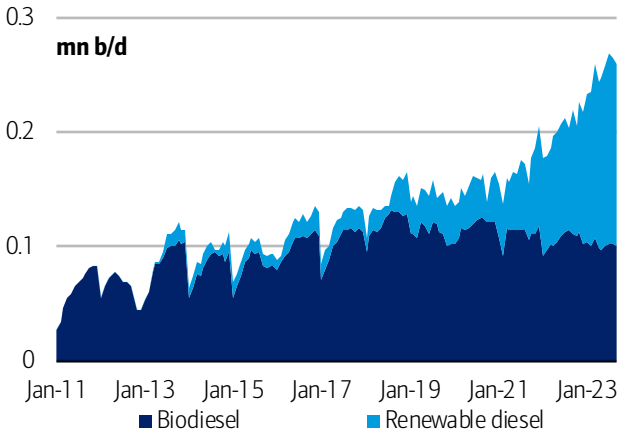
Exhibit 258: US biomass based diesel capacity growth
In 2022-23, renewable diesel capacity is estimated to have risen roughly 1.8bn gal/yr, and we expect capacity additions in 2024 to top 1.3bn gal/yr



Source: Platts

BofA GLOBAL RESEARCH

Exhibit 259: US biomass based diesel production
These capacity additions have helped double biomass diesel supply since 2019, with some growth leveraging soybean oil as a feedstock



Source: EIA

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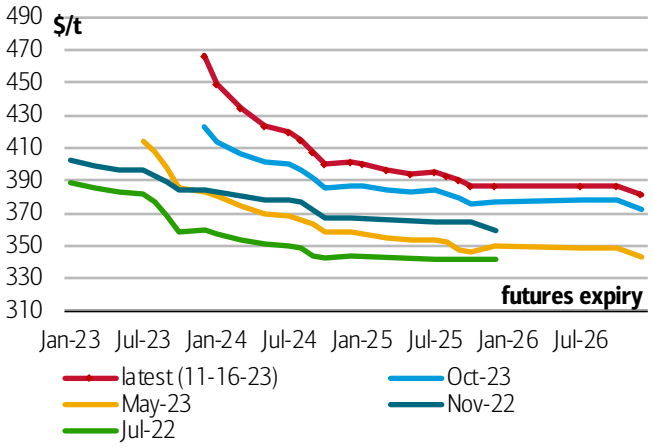
Downside to crush margins as US, Brazil, and Argentina process more

Strength in soybean crush margins has been underpinned by a run-up in soybean meal prices (Exhibit 260), which has helped offset a drop in soybean oil prices (Exhibit 261). Over the coming months, we expect crush across the Americas to remain strong, driven by a recovery in Argentina's soybean crop, solid crush margins, expanding crush capacity in the US, and a shift to higher biodiesel blending requirements in Brazil (13% by March 2024). These forces are likely to drive crush margins lower and pressure meal prices in the process, while oil prices remain more supported due to domestic biofuel feedstock demand.

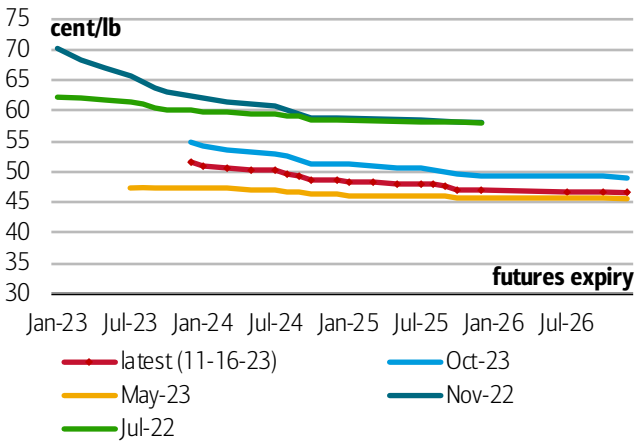
Exhibit 260: CBOT soybean meal forward curve
The recent strength in soybean crush margins has been underpinned by a run-up in soybean meal prices...



Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 261: CBOT soybean oil forward curve
...which has helped offset a drop in soybean oil prices



Source: Bloomberg

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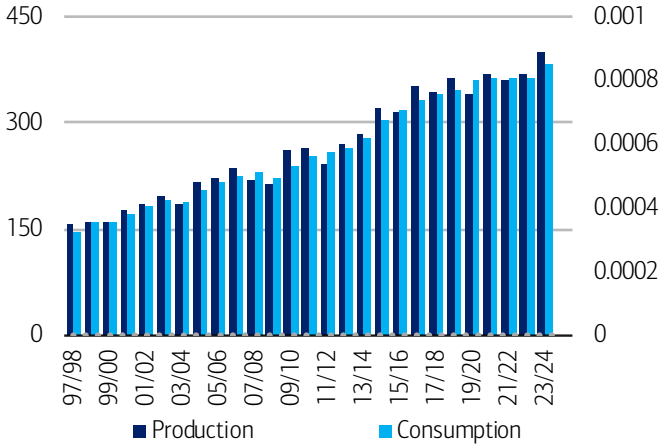
We see downside to meal and bean prices on rising ending stocks

Soybean balances are set to lengthen in 2023/24, driven by a rebound in Argentina's crop and another year of supply growth out of Brazil, which should help offset the second consecutive decline in the US crop. Even as soybean demand is estimated to rise by 19.5mn mt in 2023/24, the highest pace of growth in nearly a decade, supply growth is expected to be overwhelming (Exhibit 262). As a result, soybean ending stocks are expected to rise to a new record 115mn mt (Exhibit 263). The apparent imbalance between soybean supply and demand should help pressure soybean prices in the coming year.

Exhibit 262: World soybean production and consumption

Even as soybean demand is estimated to rise by 19.5mn mt in 2023/24, the highest pace of growth in nearly a decade, supply growth is expected to be overwhelming

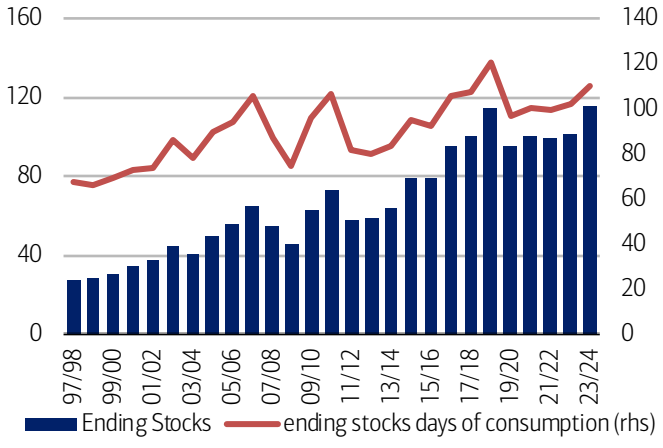


Source: USDA

BofA GLOBAL RESEARCH

Exhibit 263: World soybean ending stocks

As a result, soybean ending stocks are expected to rise to a new record 115mn mt



Source: USDA

BofA GLOBAL RESEARCH

5.3 Wheat

Wheat prices have completely retraced to 2021 levels

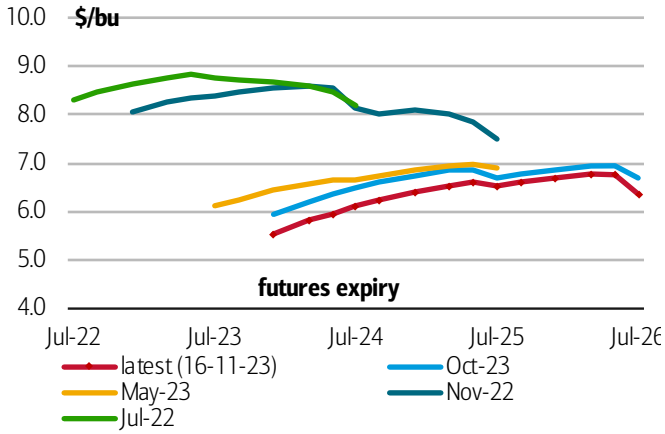
After a meteoric rise to record levels of more than $14/bu in 2022, wheat prices have fallen back to earth (Exhibit 264), driven by resilient wheat supplies, which hit new record highs despite concerns around the impact of war in Ukraine on Black Sea crops and exports. Wheat prices have fallen below $5.60/bu recently, the lowest level since late 2020. The forward curve for wheat has also shifted too, with forward prices coming down and the curve shifting into contango recently (Exhibit 265).

Exhibit 264: Soft red winter wheat front month prices
After a meteoric rise to record levels of more than $14/bu in 2022, wheat prices have fallen back to earth

Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 265: Soft red winter wheat forward curve
The forward curve for wheat has also shifted too, with forward prices coming and the curve shifting into contango recently



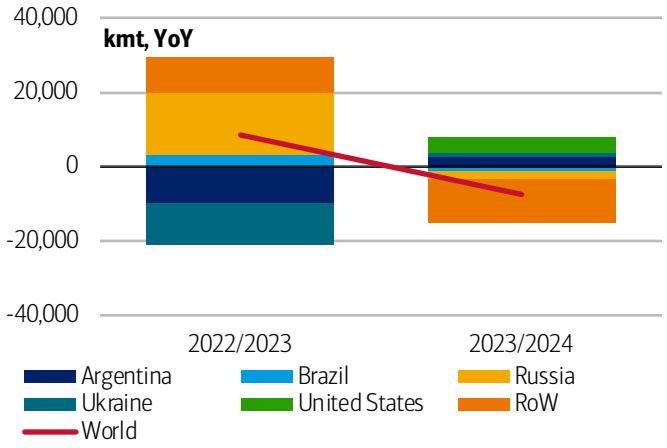
Source: Bloomberg

BofA GLOBAL RESEARCH

Global wheat supply to decline in 2023/24 as Australia's crop shrinks

The 2022/23 wheat crop rose nearly 8.5mn mt YoY despite an estimated 11.5mn mt decline in Ukrainian supply and a 9.6mn mt reduction in Argentina's crop. Offsetting these shrinking crops were Russia (+16.8mn mt YoY) and growth elsewhere in the world (Exhibit 266). Global supplies are set to decline in 2023/24 by roughly 7.5mn mt YoY, driven in large part by a decline in Australia's crop, which suffered from hot and dry conditions this season. The collapse in wheat prices since mid-2022 has outpaced corn and at times pushed wheat to parity with corn, driving some feed switching to wheat (Exhibit 267). Today, the wheat-corn ratio is trading slightly above switching levels, and we expect this should persist given the general tightness expected in the wheat market.

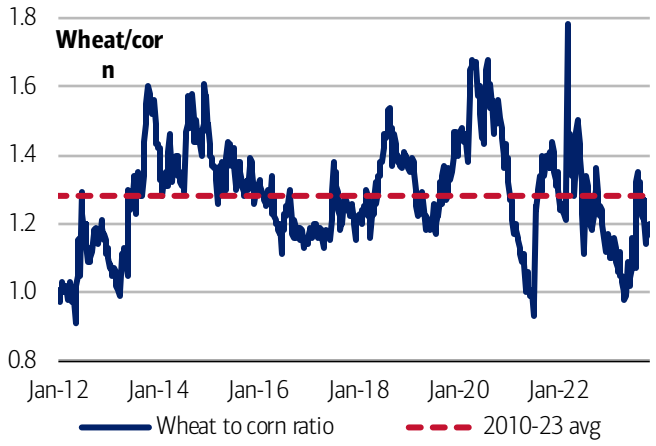
Exhibit 266: Global wheat production growth
Global wheat supplies are set to decline in 2023/24 by roughly 7.5mn mt YoY, driven in large part by a decline in Australia's crop



Source: USDA

BofA GLOBAL RESEARCH

Exhibit 267: Wheat to corn ratio
The collapse in wheat prices since mid-2022 has outpaced corn and at times pushed wheat to parity with corn, driving some feed switching to wheat



Source: Bloomberg

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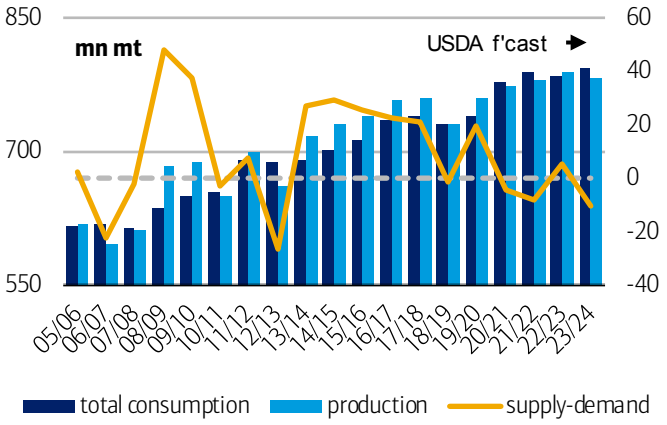
We see more upside than downside to wheat on falling carryout

Rising demand and contracting supply should tip the wheat market into deficit this year (Exhibit 268), providing support for prices. Furthermore, wheat demand could surprise to the upside versus expectations due to significantly lower prices YoY and the relative attractiveness of wheat. Given expectations for a 10mn mt deficit expected this year, carryout should drop for the fourth consecutive year to 259mn mt (Exhibit 269).

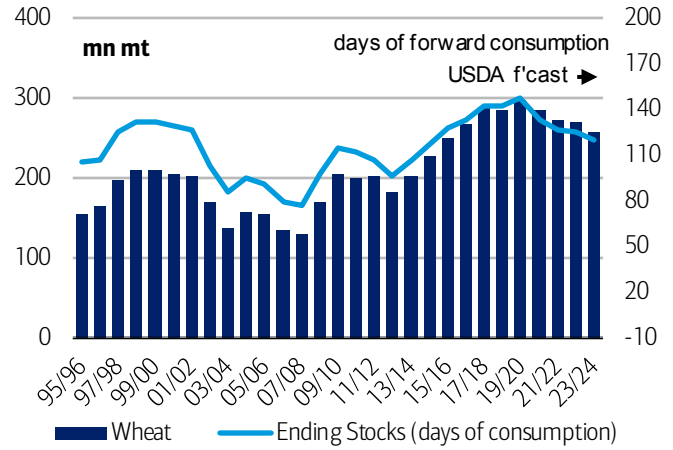
Exhibit 268: Global wheat supply and demand
Rising demand and contracting supply should tip the wheat market into deficit this year



Source: USDA

BofA GLOBAL RESEARCH

Exhibit 269: Global wheat ending stocks
Given the 10mn mt deficit expected this year, carryout should drop for the fourth consecutive year to 259mn mt



Source: USDA

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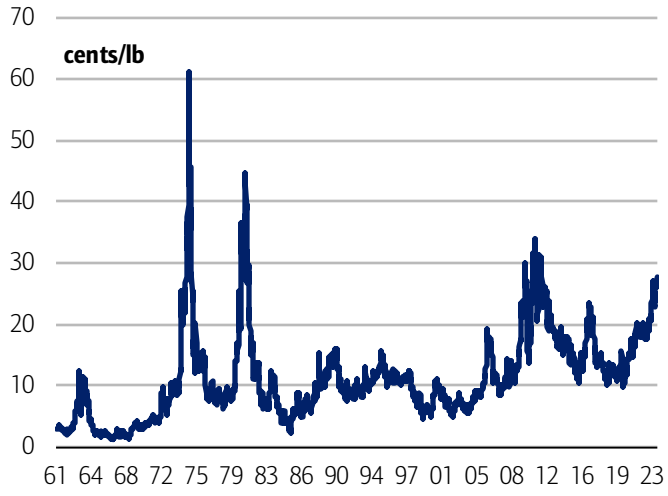
5.4 Sugar

Sugar prices have soared in 2023 on sluggish supply, export woes

Global sugar prices have extended a multi-year rally into 2023, with prices recently topping $0.28/lb recently (Exhibit 270), the highest level since the early 2010s, when prices nearly reached $0.34/lb. The performance of sugar has varied by region, with US and Brazilian domestic prices more than doubling since the start of 2020, while prices in China and India rallied about 20% (Exhibit 271). Extreme weather, particularly drought in places like India and logistical constraints in Brazil have contributed to the strength in prices in recent years.

Exhibit 270: Sugar front month prices
Global sugar prices have extended a multi-year rally into 2023, with prices recently topping $0.28/lb



Source: Bloomberg

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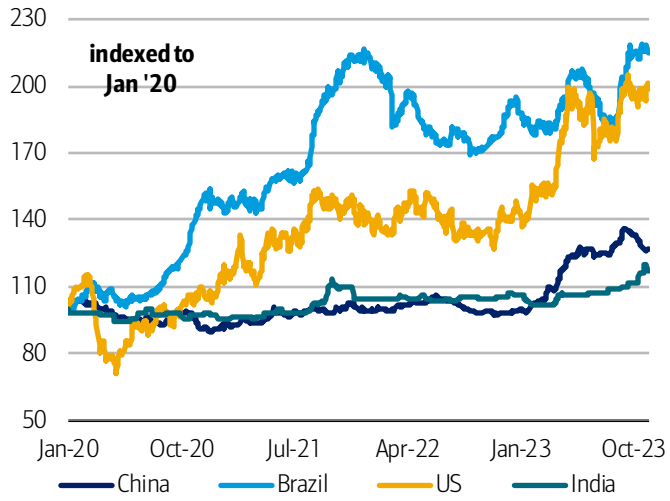
Exhibit 271: Sugar Prices by country
The performance of sugar has varied by region, with US and Brazilian domestic prices rallying more than doubling since the start of 2020, while prices in China and India rallied about 20%



Source: Bloomberg

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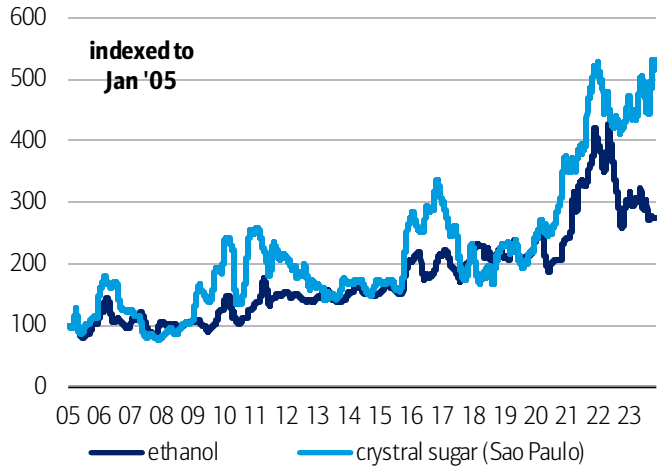
Margins favor sugar vs ethanol in Brazil, but port issues limit exports

In Brazil, the incentive to produce sugar over ethanol has increased significantly since energy prices collapsed in late 2022/early 2023 (Exhibit 272). With margins favoring sugar, cane crushers should produce more, but the increase in sugar production is likely to continue to struggle to reach the global market. For one, persistent port congestion has hampered loadings, and rainfall has further slowed vessel loading times, especially in recent weeks (Exhibit 273). Drought in the north, which has curbed vessel activity on the Amazon, has also put more stress on Santos and other ports. Tonnage leaving India is also constrained thanks to government-imposed export restrictions, which were also been placed on rice and wheat recently. The goal of curbing exports is to tamp down on inflation domestically, but the effect has been more inflated prices globally. Last year, India was reportedly the second largest sugar exporter, but restrictions this year have likely knocked in back in the rankings.

Exhibit 272: Brazil sugar and ethanol prices, indexed
In Brazil, the incentive to produce sugar over ethanol has increased significantly since energy prices collapsed in late 2022/early 2023



Source: Bloomberg

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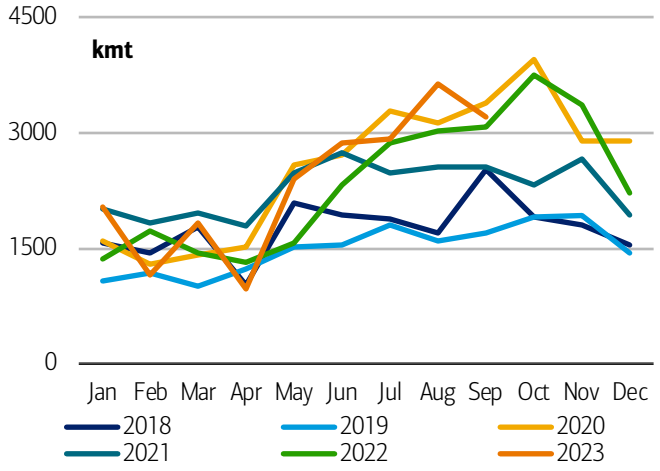
Exhibit 273: Brazil sugar exports
Persistent port congestion has hampered loadings, and rainfall has further slowed vessel loading times, especially in recent weeks



Source: Bloomberg

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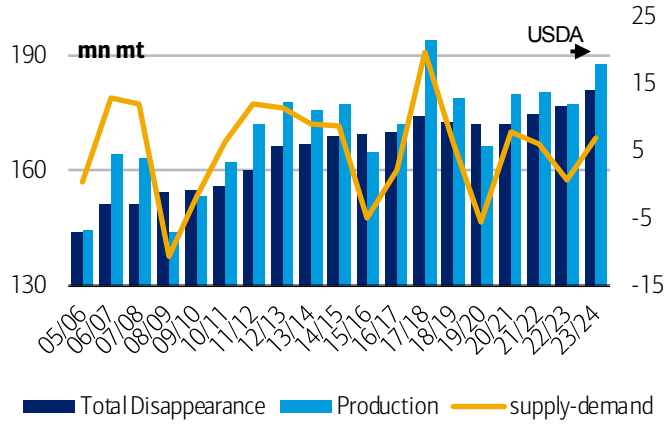
We are neutral sugar, see downside price risk if export constraints ease

Sugar prices have strengthened this year on a variety of factors, including robust demand growth from Asia and the Middle East, drought related crop concerns, and government imposed and weather-related export constraints. Production is expected to rise to a multi-year high this year (Exhibit 274), but sugar availability to the broader market may remain constrained. Global carry out is set to decline for the third year in row, with days of demand dropping to the lowest levels since 2009/10 (Exhibit 275). Sugar prices are admittedly lofty, but we expect prices to remain supported near current levels until export constraints ease, but this will depend on rainfall at Brazil's ports or a change in government-imposed exports constraints in India.

Exhibit 274: Global sugar supply and demand
Sugar production is set to surge higher this year, but getting sugar from Brazilian ports to buyers remains a challenge



Source: USDA

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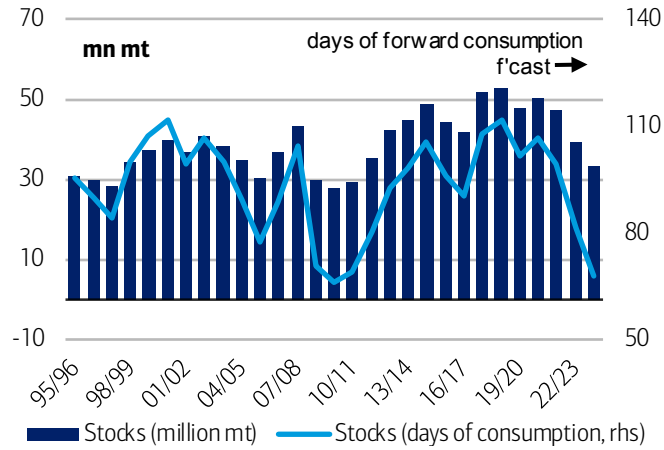
Exhibit 275: Global sugar carryout
Ending stocks are projected to decline in 2023/24 to 33.4mn mt



Source: USDA

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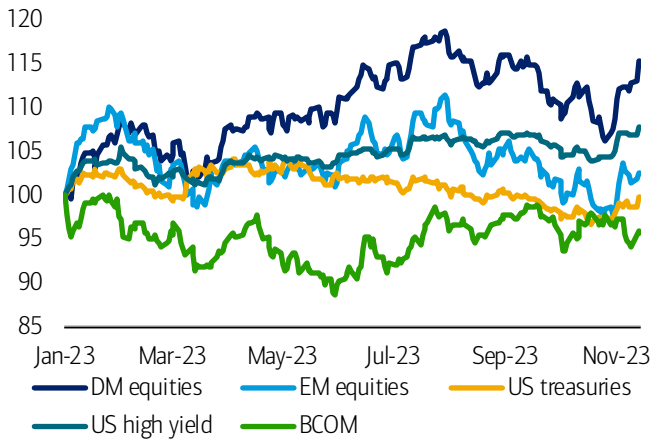
6. Portfolio strategy outlook

Equities set to end year higher, while rates and commodities faltered

2023 marked a year of divergences but also continuation, as while equities and risk assets were able to push higher, yields continued their rise higher as well, weighing on rates positions (Exhibit 276). Commodities however are set to end the year flat to lower as weakness in the first half driven by a weaker China re-opening was not fully offset by stronger softs returns throughout the year, nor energy strength in the second half that is now receding on the back of expanding supply and weaker demand in the products (Exhibit 277).

Exhibit 276: Year-to-date cumulative cross-asset returns indexed to Jan-23

Equities are exhibiting positive year-to date returns despite an even higher rate environment...



Source: Bloomberg

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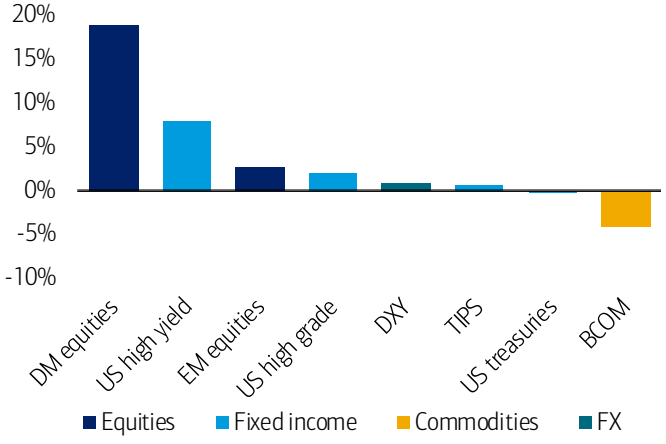
Exhibit 277: Year-to-date cross-asset returns

... while commodities have negative returns year-to-date due a weak first half that has not been fully offset by second half strength



Source: Bloomberg

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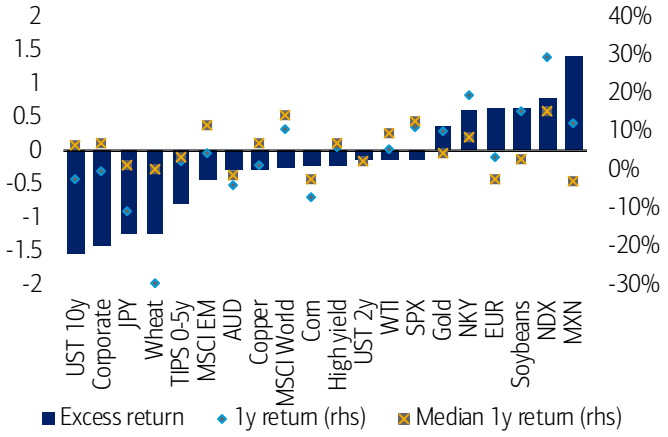
Rates continue to dominate cross-asset landscape and control risk assets

With rates vol still leading the way cross-asset, we continue to see cross-asset dynamics dictated largely by the rates complex. While themes such as AI have helped push up equities and risk assets despite upward drift in nominal yields, the spectre of higher rates for longer has still weighed as cross-asset returns are largely underperforming their historical annual medians (Exhibit 278). There are however exceptions, most notably in FX carry currencies such as the Mexican peso, but also commodities such as gold and soybeans, and tech equities that have displayed better than median performance this year, despite the ramp up in rates.

Rates and risk assets continue to be positively correlated, as the first principal component of cross-asset returns over the past year exhibits positive loadings across, in sharp contrast to longer term dynamics (Exhibit 279). Commodities have also displayed a shift as their loadings onto the primary cross-asset risk factor have been muted and even negative, rather than positive as is the historical norm. This suggests that commodities could indeed be providing some diversification to multi-asset portfolios if the current environment continues.

Exhibit 278: Cross-asset returns in excess of median returns scaled by volatility (1-year)
The higher rates environment has kept cross-asset returns muted relative to historical medians



Source: BofA Global Research estimates, Bloomberg

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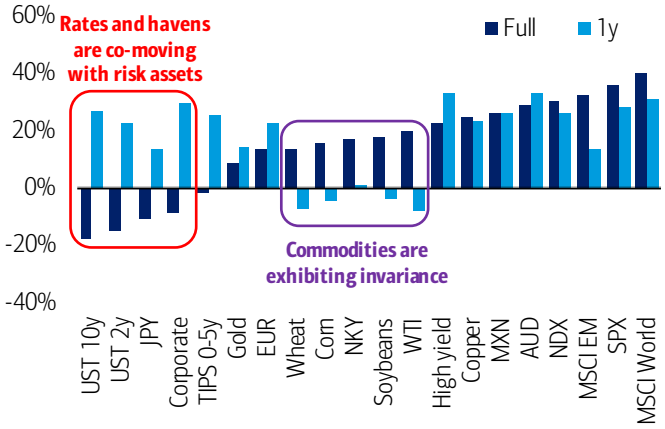
Exhibit 279: Cross-asset principal component loadings since Jan 1999 and over past year
Cross-asset returns are exhibiting positive correlation, as higher rates continue to be aligned with lower risk asset returns, but commodities have displayed marked invariance



Source: BofA Global Research estimates, Bloomberg

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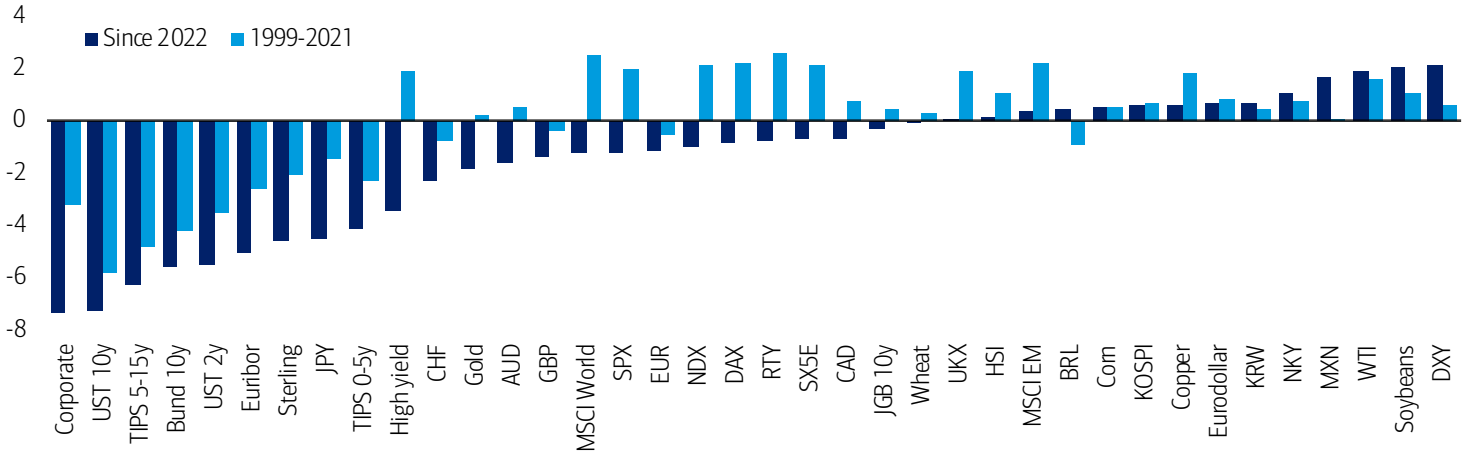
The dollar and commodities have shielded against rates moves, unlike equities

Rates volatility has been the norm over the past 2 years and we have continued to see longer end yields realize high volatility. Multi-asset portfolios have seen little solace on days when rates sold off in earnest over the past 2 years, as risk assets and equities have fallen as well (Exhibit 280). This is in contrast to historical averages where large increases in yields were typically associated with risk-on and positive risk asset returns, but this dynamic has flipped. The dollar and commodities however have maintained and increased their average returns when 10y rates have sold off in size during this tightening cycle. Higher rates may weigh on equities and risk assets currently, but the dollar has been a beneficiary while commodities have been more invariant and subject to their own idiosyncratic drivers.

Exhibit 280: Average cross-asset returns relative to median (scaled by volatility) when daily 10 year US treasury yield change is in top decile
Since 2022, equity, fixed income, and FX returns have been dismal on days when yields have sharply risen compared to history, while the dollar and commodities have maintained or exceeded their historical median returns



Source: BofA Global Research estimates, Bloomberg

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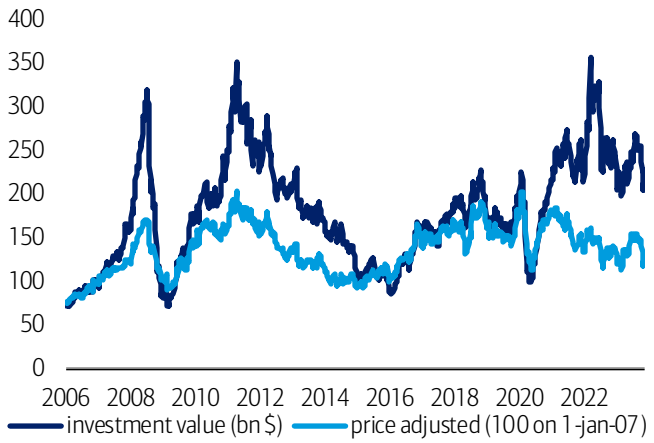
Weak returns and lack of diversification led to low commodity allocations...

Before the inflation bout, commodities had been a shunned asset class. Nearly a decade of poor returns, high volatility on the back of oversupply and sluggish growth, and dormant inflation led to lower allocations in the asset class (Exhibit 281). Indeed even

from a quantitative standpoint, commodities exhibited strong positive correlations with equities but worse risk-adjusted returns, leading asset allocation frameworks such as mean variance optimization to allocate less to the asset class over the past decade (Exhibit 282). However, this has noticeably shifted as improved returns coupled with changes in covariances with equities and bonds as of late have led to higher implied allocations. While these changes are contingent on expected returns and covariances continuing their current dynamics, a regime shift would indeed warrant increased commodity allocations moving forward.

Exhibit 281: Commodity index assets under management
Commodity beta tracking AUMs have receded and real allocations remain low relative to history



Source: BofA Global Research, CFTC

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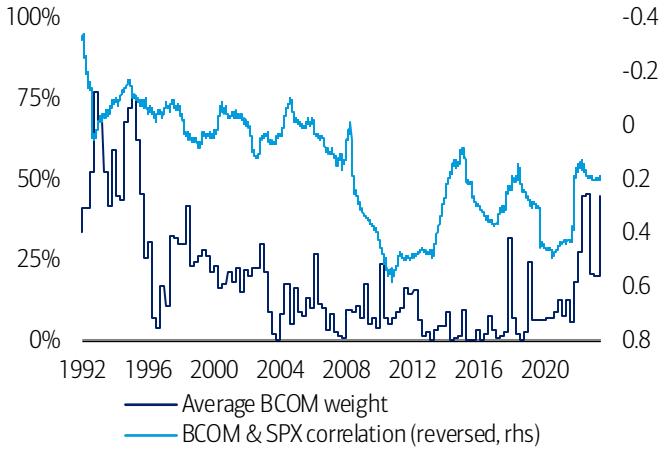
Exhibit 282: Mean variance optimal weights for BCOM in portfolio with SPX and 10y US treasury futures averaged across lookback windows, and BCOM/SPX correlation
Mean variance implied allocations to commodities have increased as commodities exhibited higher returns and better diversification over the past 2 years compared to the 2010s



Source: BofA Global Research, Bloomberg. Data from May-1987 to Nov-2023. Mean variance optimal weight is the average of weights estimated from rolling 3-, 6-, 12-, 24-, 60-, and 120-month lookback windows.

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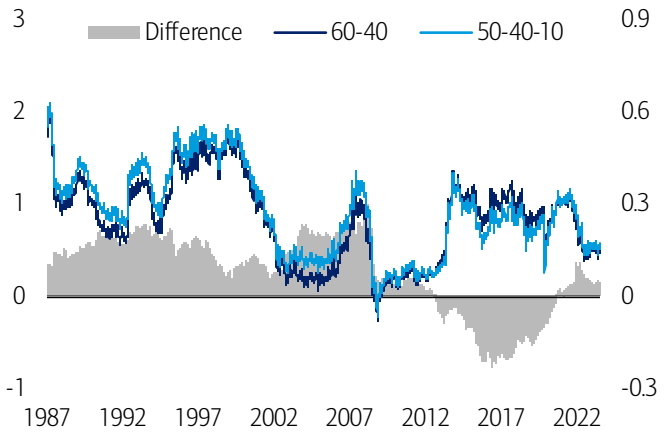
... but a sustained shift towards recent dynamics could suggest a larger role

Given the changes in cross-asset dynamics, but also fundamental drivers, do commodities warrant a larger allocation in multi-asset portfolios? Comparing a traditional 60-40 portfolio of S&P 500 and 10y US treasuries to one with 10% notional allocated to commodities suggests yes as commodity inclusion would have improved 5-year rolling information ratios for most of the last 25 years (Exhibit 283). This was especially prominent in the 1990s when commodities and equities were less correlated compared to the past decade, highlighting the importance of diversification. The decrease in commodity allocations over the past decade were indeed justified given the higher correlation between commodities and equities, and underperformance of the 60-50-10 portfolio relative to 60-40 until late 2020. But now that we have seen nascent signs of changes in covariances and returns, a return to commodity allocations at levels prior to the 2010s may be in order.

Comparing across various allocations, we find that the highest information ratios for portfolios would have come from commodities and equities having a similar weights (Exhibit 284). That being said, even a 10% allocation would have improved from no allocation to commodities at all, highlighting the benefits of diversifying through commodities.

Exhibit 283: Rolling 5-year information ratios for 60-40 portfolio with SPX and 10y US treasury futures, and 60-50-10 with SPX, 10y US treasury futures, and BCOM

Adding commodities to an equity bond portfolio would have supported risk adjusted returns outside of the 2010-2020 period when returns and diversification were low...



Source: BofA Global Research, Bloomberg. Data from May-1987 to Nov-2023.

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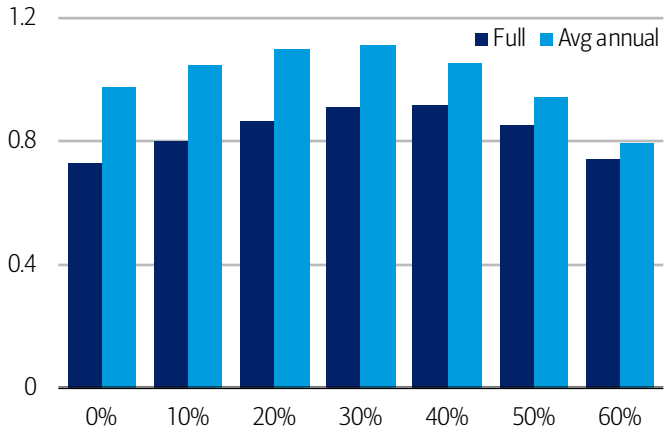
Exhibit 284: Average annual and full information ratios for portfolios holding 40% US treasuries, S&P 500, and varying allocations to BCOM

... with closer to an even split between equities and commodities suggesting the highest historical information ratios, both across the full sample and averaged annually



Source: BofA Global Research. Data from May-1987 to Nov-2023.

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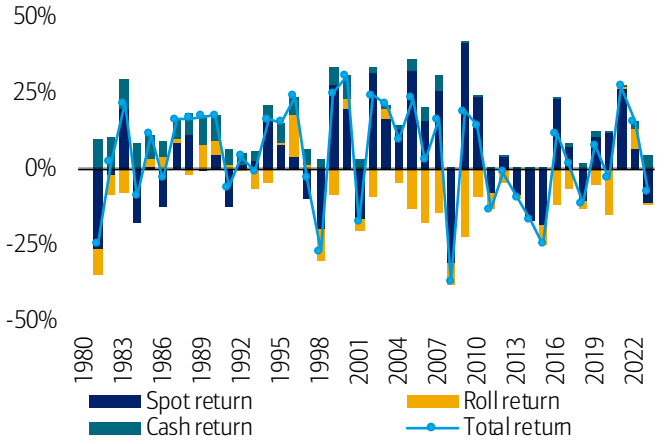
Roll returns have been awash, leaving weaker spot returns to dominate

2023 marked a shift in the composition of commodity returns as the positive forces driving returns over the past 2 years were reversed in the first half of the year, leaving spot returns negative and roll returns slightly negative as well for the broad index (Exhibit 285). Divergence in sector returns has also been reflected in commodity curves which remain split, with the softs, energy, and soybeans in backwardation, while the industrial metals, grains, and livestock are in contango (Exhibit 286). If growth continues to soften, we expect most curves to stay in contango, and for backwardation to ease, which points towards weaker roll returns in the coming year. However, if demand stays solid and/or supply cuts or disruptions emerge, we could see a continuation of the current divergence in curve shapes.

Exhibit 285: Annual BCOM spot, excess, and roll returns

Commodity index total returns are negative year-to-date, largely on the back of softer commodity prices in 1H that have not recovered enough in 2H, and roll returns have been awash



Source: Bloomberg

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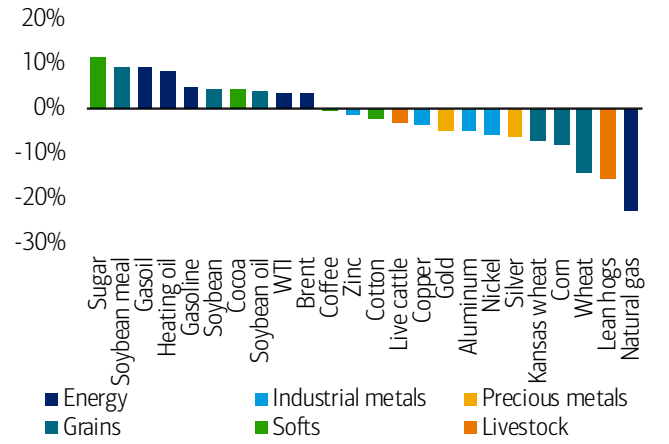
Exhibit 286: Commodity 12-month backwardation (1st – 12th month scaled by 1st month)

Commodity curves are split, as while the softs and energy are in backwardation, metals, most grains, and livestock are in contango



Source: BofA Global Research, Bloomberg

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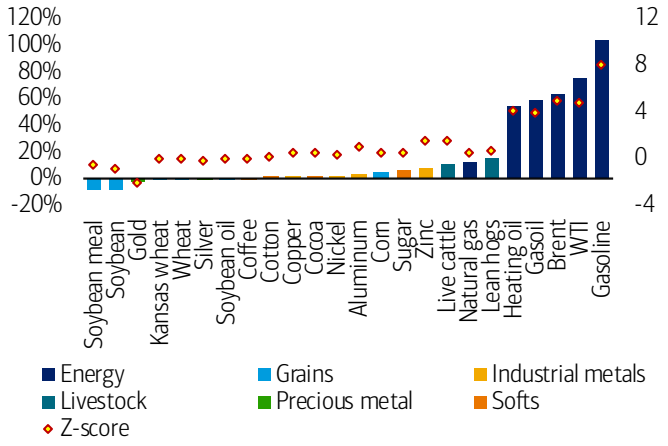
Recessions steepen energy contango, so slow growth could dampen roll returns

While our global economics team's baseline forecast is slower growth but no recession in 2024, we find it informative to quantitatively assess commodity curve dynamics

during contracting growth periods. Intuitively we would expect commodity curves to steepen into contango, which we confirm when looking across US recessions on a commodity-by-commodity basis (Exhibit 287). More interestingly, we find that energy commodities have exhibited the largest curve steepening relative to other sectors by a significant margin. Given that energy is one of the only two backwardated sectors at the moment, an environment of expanding oil supply and slowing economic growth is more than likely to compress backwardation, and even push curves into contango, which would leave softs as the only sector with positive roll returns.

Exhibit 287: Average annualized change in 1-year commodity curves across US recessions (12th month minus 1st month scaled by 1st month)

Commodity curves tend to steepen towards contango during recessions, with energy commodity curves exhibiting the largest moves by far



Source: BofA Global Research, Bloomberg

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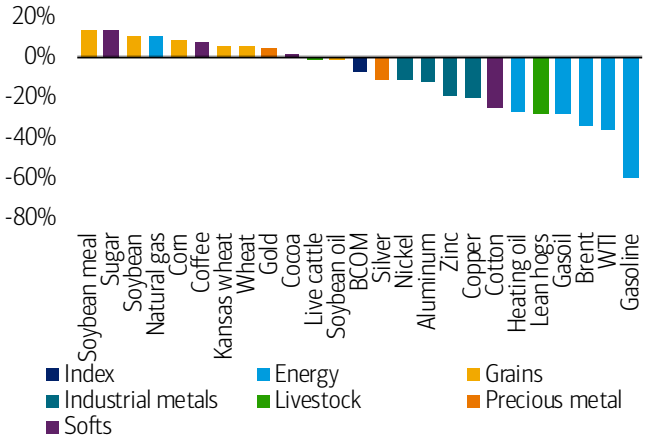
Exhibit 288: Average annualized commodity front month futures returns across Fed cutting cycles

Similarly, energy and industrial metals tend to fall during Fed cutting cycles as they have coincided with periods of macro weakness and soft demand, while grains have held up



Source: BofA Global Research, Bloomberg

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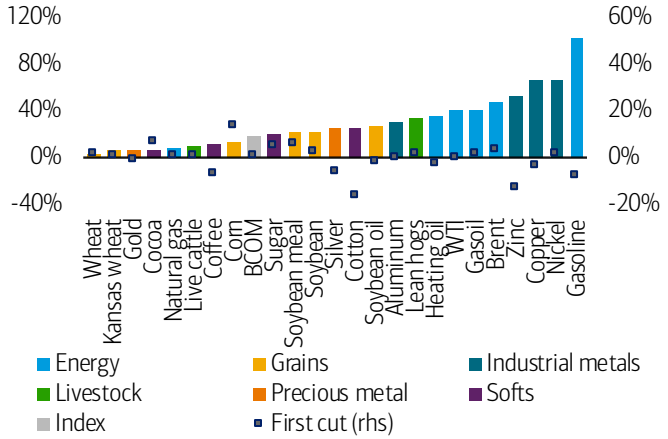
Impact of rate cuts on commodity returns and curves depends on cut catalyst

Emerging market central banks have begun their cutting cycles, and our economists and markets are expecting developed market central banks to join the cutting efforts by mid next year. The anticipation and delivery of rate cuts should be positive for risk assets and commodities, but the cumulative response will depend on the context of the rate cuts, in our view. Historically the beginning and duration of cutting cycles have coincided with macro weakness, recession, and risk-off. As a result, commodities have underperformed on average through cutting cycles, with the bulk of pain inflicted on energy and industrial metals, and gold as one of the sole beneficiaries (Exhibit 288). What's interesting is that in the year following the last cut of easing cycles, commodities on average have reflated in size almost universally across, magnitudes above the average 1-year response following the first cut (Exhibit 289). This implies that if rate cuts arrive at a time when growth is falling significantly, any upside will likely be short-lived as macro weakness dominates. However if rate cuts begin under a regime of progress on disinflation and slower, but not dire growth, we could see upside more akin to the terminus of cutting cycles, rather than beginning.

Finally in terms of curve shapes, cumulative moves through Fed cycles are mixed and idiosyncratic, as energy commodity curves steepen towards contango, while grains and precious metals see their contangos flatten (Exhibit 290). We again highlight that curve dynamics are strongly contingent on the context of the cutting cycle, as a softer landing type of environment could lead to more bullish curve action and shifts towards backwardation. But if cuts arrive due to macro stress, we could see cyclical commodity curves steepen further from backwardation into contango, eroding roll returns for the complex.

Exhibit 289: Average commodity returns in 1-year after first and last cut of Fed cutting cycles

Cyclical reflation of commodities historically has occurred after the last cut of the cycle as macro concerns are eased and a new bull market emerges



Source: BofA Global Research, Bloomberg

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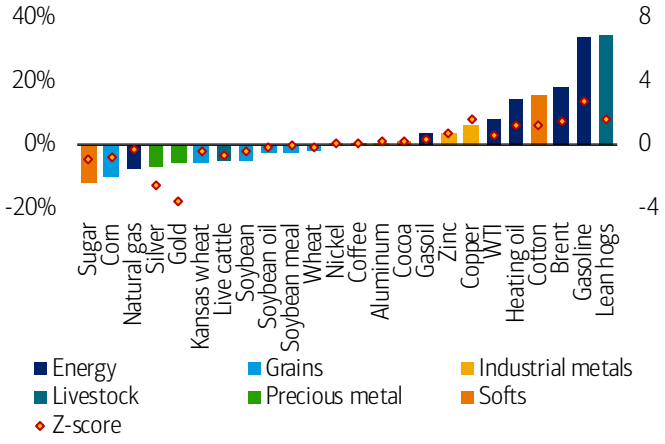
Exhibit 290: Average annualized change in 1-year commodity curves across Fed cutting cycles (12th month minus 1st month scaled by 1st month)

Commodity curve responses are mixed across Fed cutting cycles, but point towards steepening into contango for macro commodities like crude oil and copper, and flattening into backwardation of gold and silver



Source: BofA Global Research, Bloomberg

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Appendix – Commodity balance tables

Exhibit 291: BofA global oil supply forecast (in thousand b/d)
Quarterly forecast

	2022	1Q2023F	2Q2023F	3Q2023F	4Q2023F	2023F	1Q2024F	2Q2024F	3Q2024F	4Q2024F	2024F
OECD Americas	**25,690**	**26,680**	**26,850**	**27,380**	**27,780**	**27,170**	**27,630**	**27,780**	**28,040**	**28,310**	**27,940**
United States	**17,920**	18,720	19,250	19,620	19,700	**19,320**	19,570	19,920	20,050	20,100	**19,910**
-Crude	***11,910***	*12,630*	*12,750*	*13,060*	*13,170*	***12,900***	*13,150*	*13,240*	*13,300*	*13,420*	***13,280***
-NGL	***5,930***	*6,010*	*6,420*	*6,470*	*6,450*	***6,340***	*6,340*	*6,580*	*6,670*	*6,610*	***6,550***
Canada	**5,750**	5,850	5,450	5,660	5,980	**5,730**	5,950	5,800	5,880	6,100	**5,930**
Mexico	**2,010**	2,100	2,140	2,100	2,100	**2,110**	2,100	2,050	2,100	2,100	**2,090**
OECD Asia Oceania	**480**	**460**	**460**	**460**	**460**	**460**	**470**	**470**	**450**	**450**	**460**
Australia	**410**	390	380	380	400	**390**	400	400	390	390	**390**
OECD Europe	**3160**	**3280**	**3220**	**3010**	**3220**	**3,180**	**3290**	**3140**	**3190**	**3290**	**3,230**
Norway	**1,900**	2,000	2,000	1,940	2,050	**2,000**	2,100	2,000	2,050	2,100	**2,060**
United Kingdom	**830**	830	770	620	750	**740**	780	730	730	780	**750**
Non-OECD Europe	**110**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**90**	**100**
Former Soviet Union	**13,900**	**14,150**	**13,790**	**13,590**	**13,660**	**13,800**	**13,400**	**13,500**	**13,550**	**13,650**	**13,530**
Russia	**11,090**	11,200	10,910	10,810	10,800	**10,930**	10,500	10,600	10,700	10,700	**10,630**
Azerbaijan	**670**	640	620	620	640	**630**	640	640	640	630	**640**
Kazakhstan	**1,820**	1,990	1,950	1,850	1,900	**1,920**	1,950	1,950	1,900	2,000	**1,950**
Non-OPEC Africa	**1,290**	**1,230**	**1,270**	**1,310**	**1,310**	**1,280**	**1,300**	**1,300**	**1,300**	**1,290**	**1,300**
Egypt	**600**	590	600	600	590	**600**	590	590	590	590	**590**
Sudan	**200**	170	200	240	230	**210**	220	220	210	210	**220**
Non-OPEC Asia	**6,880**	**7,030**	**7,000**	**6,830**	**6,850**	**6,930**	**6,940**	**6,930**	**6,930**	**6,920**	**6,930**
India	**700**	680	690	690	700	**690**	700	710	710	710	**710**
Malaysia	**560**	580	550	540	550	**550**	550	550	540	540	**550**
China	**4,180**	4,340	4,340	4,210	4,210	**4,270**	4,310	4,310	4,320	4,320	**4,320**
Non-OPEC Latin America*	**5,640**	**5,960**	**6,000**	**6,280**	**6,410**	**6,160**	**6,530**	**6,640**	**6,690**	**6,690**	**6,640**
Argentina	**710**	750	760	760	760	**760**	770	780	790	800	**790**
Brazil	**3,120**	3,300	3,320	3,630	3,700	**3,490**	3,750	3,750	3,800	3,800	**3,780**
Colombia	**760**	780	790	790	790	**790**	780	770	770	760	**770**
Guyana	**270**	380	380	360	430	**390**	500	600	600	600	**580**
Non-OPEC Middle East	**3,160**	**3,130**	**3,150**	**3,110**	**3,150**	**3,140**	**3,170**	**3,170**	**3,160**	**3,160**	**3,160**
Oman	**1,072**	1,072	1,059	1,047	1,052	**1,057**	1,072	1,069	1,057	1,062	**1,065**
Qatar	**1,801**	1,813	1,812	1,811	1,810	**1,811**	1,810	1,810	1,810	1,810	**1,810**
Processing Gains	**2,310**	2,310	2,350	2,380	2,370	**2,350**	2,440	2,440	2,440	2,440	**2,440**
Global Biofuels	**2,940**	2,670	3,280	3,590	3,170	**3,180**	2,770	3,390	3,680	3,270	**3,280**
Non-OPEC (incl. processing gains)**	**65,580**	**67,010**	**67,470**	**68,050**	**68,480**	**67,750**	**68,040**	**68,840**	**69,510**	**69,560**	**68,990**
OPEC crude	**29,080**	**29,380**	**28,890**	**28,010**	**28,180**	**28,620**	**28,130**	**28,200**	**28,430**	**28,490**	**28,310**
Saudi Arabia crude	**10,530**	10,420	10,140	9,020	9,000	**9,650**	9,000	9,000	9,000	9,000	**9,000**
Kuwait	**2,700**	2,700	2,630	2,570	2,570	**2,620**	2,500	2,500	2,570	2,570	**2,540**
UAE	**3,340**	3,440	3,270	3,230	3,200	**3,290**	3,200	3,200	3,300	3,300	**3,250**
Iraq crude	**4,440**	4,390	4,140	4,310	4,350	**4,300**	4,350	4,350	4,350	4,350	**4,350**
Iran crude	**2,550**	2,700	3,000	3,110	3,200	**3,000**	3,250	3,300	3,350	3,400	**3,330**
Libya crude	**990**	1,150	1,160	1,150	1,150	**1,150**	1,150	1,150	1,150	1,150	**1,150**
Nigeria crude	**1,150**	1,270	1,150	1,210	1,300	**1,230**	1,300	1,300	1,300	1,300	**1,300**
Venezuela crude	**700**	710	790	790	850	**790**	880	900	930	950	**910**
other OPEC crude	**2,680**	2,590	2,610	2,620	2,570	**2,600**	2,510	2,500	2,480	2,470	**2,490**
Total OPEC NGLs + Non-conventional	**5,430**	5,490	5,520	5,580	5,450	**5,510**	5,500	5,500	5,500	5,500	**5,500**
Total OPEC	**34,500**	**34,870**	**34,410**	**33,590**	**33,630**	**34,130**	**33,630**	**33,700**	**33,930**	**33,990**	**33,810**
Total World Supply	**100,080**	**101,880**	**101,880**	**101,640**	**102,110**	**101,880**	**101,670**	**102,530**	**103,440**	**103,560**	**102,800**

Source: IEA, EIA, BofA Global Research estimates

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Exhibit 292: BofA global oil demand forecast (in thousand b/d)
Quarterly forecast

	2022	1Q2023F	2Q2023F	3Q2023F	4Q2023F	2023F	1Q2024F	2Q2024F	3Q2024F	4Q2024F	2024F
TOTAL OECD Demand	**45,750**	**45,430**	**45,710**	**46,090**	**46,210**	**45,860**	**45,010**	**45,560**	**45,850**	**45,970**	**45,600**
OECD Americas Demand	**24,870**	24,520	25,210	25,470	25,230	**25,110**	24,460	25,000	25,270	25,100	**24,960**
United States	**20,160**	19,920	20,500	20,470	20,300	**20,300**	19,800	20,220	20,300	20,110	**20,110**
Canada	**2,410**	2,330	2,470	2,690	2,580	**2,520**	2,370	2,510	2,630	2,630	**2,530**
Mexico	**1,930**	1,890	1,870	1,940	1,990	**1,920**	1,910	1,890	1,960	2,010	**1,940**
OECD Europe Demand	**13,510**	13,100	13,540	13,550	13,250	**13,360**	12,890	13,410	13,290	13,130	**13,180**
OECD Pacific Demand	**7,380**	7,810	6,960	7,070	7,720	**7,390**	7,660	7,150	7,290	7,730	**7,460**
TOTAL NON-OECD Demand	**53,840**	**54,820**	**55,400**	**56,400**	**56,640**	**55,820**	**56,620**	**56,970**	**57,370**	**57,880**	**57,210**
China	**14,660**	15,490	15,980	16,430	16,340	**16,060**	16,200	16,560	16,610	16,800	**16,540**
India	**5,280**	5,570	5,520	5,250	5,700	**5,510**	5,790	5,790	5,490	5,940	**5,750**
Other Asia (ex. China & India)	**8,780**	8,840	8,870	8,850	9,040	**8,900**	9,110	9,080	9,020	9,230	**9,110**
Middle East	**8,900**	8,780	8,870	9,450	8,960	**9,010**	9,050	9,240	9,640	9,120	**9,260**
Latin America	**6,210**	6,180	6,310	6,450	6,350	**6,320**	6,340	6,350	6,530	6,460	**6,420**
FSU	**4,940**	4,870	4,900	5,070	5,020	**4,970**	4,900	4,920	5,090	5,030	**4,980**
Africa	**4,280**	4,320	4,180	4,120	4,440	**4,260**	4,430	4,260	4,200	4,510	**4,350**
Non-OECD Europe	**790**	780	760	780	780	**780**	810	770	800	790	**790**
TOTAL Demand	**99,590**	**100,250**	**101,110**	**102,490**	**102,840**	**101,670**	**101,630**	**102,530**	**103,220**	**103,850**	**102,810**
Market imbalance (supply - demand)	**490**	**1,630**	**770**	**-850**	**-730**	**210**	**40**	**0**	**220**	**-290**	**-10**

Source: IEA, EIA, BofA Global Research estimates

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Exhibit 293: US natural gas supply/demand balance
Monthly, yearly, and seasonal average figures (Bcf/d)

Month	Dry production	Canadian imports	LNG imports	Total Supply	Res/Com	Industrial	Power	Mexican exports	LNG exports	Plant fuel	Pipe loss	Vehicle	Total Demand	Ending storage
Nov-21	97.4	5.2	0.1	102.6	27.1	23.3	28.9	5.5	11.2	5.3	3.2	0.1	104.7	3,505
Dec-21	98.1	4.6	0.1	102.8	34.3	23.8	28.3	5.4	12.2	5.3	3.6	0.1	113.0	3,185
Jan-22	95.2	6.7	0.2	102.2	48.5	25.3	30.9	5.7	12.5	5.1	4.3	0.2	132.6	2,193
Feb-22	95.0	6.4	0.2	101.5	44.7	24.7	29.0	5.5	12.4	5.1	4.1	0.2	125.7	1,541
Mar-22	96.7	4.9	0.1	101.6	31.3	23.2	25.1	5.5	12.9	5.2	3.3	0.2	106.6	1,381
Apr-22	97.4	5.5	0.0	102.9	21.9	22.3	24.9	5.9	12.1	5.2	2.9	0.2	95.3	1,591
May-22	98.2	4.9	0.0	103.1	12.3	20.8	29.8	6.0	12.5	5.2	2.6	0.2	89.4	1,979
Jun-22	98.5	5.3	0.0	103.8	9.0	20.7	38.2	6.1	11.0	5.2	2.8	0.2	93.2	2,300
Jul-22	99.5	5.9	0.1	105.5	8.2	20.4	45.1	6.1	10.7	5.3	3.1	0.2	98.9	2,478
Aug-22	100.0	5.1	0.1	105.2	7.8	20.7	44.3	5.9	10.7	5.3	3.0	0.2	97.9	2,680
Sep-22	101.5	5.7	0.0	107.2	8.7	20.6	37.3	5.6	10.9	5.4	2.8	0.2	91.5	3,114
Oct-22	101.3	5.4	0.0	106.7	14.9	21.0	30.6	5.5	11.1	5.3	2.8	0.2	91.4	3,537
Nov-22	101.3	5.2	0.0	106.5	28.7	23.0	30.0	5.4	11.3	5.3	3.4	0.2	107.2	3,470
Dec-22	99.2	6.2	0.1	105.4	42.6	23.1	32.0	5.1	12.2	5.2	4.1	0.2	124.4	2,896
Jan-23	100.9	5.4	0.1	106.4	40.9	23.3	31.0	5.3	12.2	5.3	4.0	0.1	122.2	2,441
Feb-23	101.0	5.1	0.1	106.3	39.3	23.8	31.0	5.4	13.1	5.3	3.9	0.1	122.0	2,044
Mar-23	101.9	4.6	0.0	106.5	33.4	22.6	29.9	5.7	13.3	5.3	3.6	0.1	114.0	1,823
Apr-23	101.7	4.8	0.0	106.5	19.6	21.8	28.9	5.6	14.1	5.3	2.9	0.1	98.4	2,089
May-23	102.6	4.4	0.1	107.1	12.2	20.3	32.1	6.2	13.4	5.4	2.7	0.1	92.4	2,528
Jun-23	102.4	5.2	0.0	107.7	9.2	20.3	39.0	6.8	12.4	5.4	2.9	0.1	96.0	2,870
Jul-23	102.6	5.7	0.0	108.4	8.1	20.0	47.3	6.7	12.8	5.4	3.2	0.1	103.6	3,001
Aug-23	103.6	5.7	0.0	109.3	8.0	20.6	47.1	6.9	12.9	5.4	3.2	0.1	104.1	3,134
Sep-23	103.1	5.1	0.0	108.3	8.8	20.6	40.6	6.9	12.3	5.7	3.1	0.2	98.0	3,457
Oct-23	103.2	5.4	0.1	108.7	14.3	21.1	32.2	6.5	13.3	5.8	3.0	0.2	96.4	3,776
Nov-23	103.4	5.2	0.1	108.7	27.7	23.0	28.9	5.8	14.0	5.8	3.5	0.2	108.9	3,753
Dec-23	103.5	5.7	0.2	109.4	39.1	23.6	31.1	5.5	14.3	5.8	4.0	0.2	123.5	3,317
Jan-24	103.4	6.3	0.3	110.0	46.4	24.5	31.5	5.8	14.4	5.8	4.3	0.2	132.9	2,608
Feb-24	103.4	5.9	0.2	109.5	43.2	23.9	31.3	5.9	14.4	5.8	4.2	0.2	128.7	2,051
Mar-24	103.4	5.1	0.1	108.6	31.9	23.0	28.3	6.1	14.0	5.8	3.6	0.2	112.9	1,916
Apr-24	103.4	5.4	0.0	108.8	20.3	22.3	27.7	6.3	13.6	5.8	3.1	0.2	99.2	2,204
May-24	103.4	5.3	0.0	108.7	12.3	21.6	31.0	6.7	13.0	5.8	2.9	0.2	93.4	2,678
Jun-24	103.4	5.1	0.0	108.6	9.2	21.0	38.2	7.1	12.9	5.8	3.1	0.2	97.3	3,016
Jul-24	103.5	5.4	0.1	109.0	8.0	20.8	46.3	7.2	13.5	5.8	3.3	0.2	105.0	3,141
Aug-24	103.9	5.6	0.1	109.5	7.8	20.9	46.0	7.2	13.8	5.8	3.3	0.2	105.1	3,277
Sep-24	104.0	5.2	0.0	109.2	8.9	20.9	38.6	7.0	15.5	5.8	3.1	0.2	99.9	3,556
Oct-24	104.3	5.3	0.1	109.7	14.0	21.4	30.0	6.6	15.8	5.8	3.0	0.2	96.9	3,954
Nov-24	104.8	5.0	0.1	109.8	28.0	23.2	28.1	6.4	16.7	5.8	3.5	0.2	112.0	3,889
Dec-24	105.1	5.9	0.2	111.2	39.4	23.7	30.9	6.2	16.9	5.9	4.0	0.2	127.1	3,395
Summer (April - October)														
Summer 21	94.1	4.8	0.0	99.0	11.3	20.8	33.0	6.2	10.7	5.1	2.6	0.1	89.8	3,635
Summer 22	99.5	5.4	0.0	104.9	11.8	20.9	35.7	5.9	11.3	5.3	2.8	0.2	94.0	3,537
Summer 23	102.7	5.2	0.0	108.0	11.4	20.7	38.2	6.5	13.0	5.5	3.0	0.1	98.4	3,776
Summer 24	103.7	5.3	0.0	109.1	11.5	21.3	36.8	6.9	14.0	5.8	3.1	0.2	99.6	3,954
Winter (November - March)														
Winter 20-21	90.6	5.5	0.1	96.2	37.6	23.4	26.7	5.5	10.4	4.9	3.3	0.1	111.9	1,778
Winter 21-22	96.5	5.6	0.1	102.1	37.2	24.1	28.4	5.5	12.3	5.2	3.7	0.2	116.5	1,381
Winter 22-23	100.9	5.3	0.1	106.2	37.0	23.1	30.8	5.4	12.4	5.3	3.8	0.2	118.0	1,823
Winter 23-24	103.4	5.6	0.2	109.2	37.6	23.6	30.2	5.8	14.2	5.8	3.9	0.2	121.4	1,916
Annual														
Cal 2021	93.6	5.1	0.1	98.8	22.0	21.9	30.7	5.9	10.7	5.1	2.9	0.1	99.3	3,185
Cal 2022	98.6	5.6	0.1	104.3	23.2	22.2	33.1	5.7	11.7	5.2	3.3	0.2	104.5	2,896
Cal 2023	102.5	5.2	0.1	107.8	21.7	21.7	34.9	6.1	13.2	5.5	3.3	0.1	106.6	3,317
Cal 2024	103.8	5.5	0.1	109.4	22.4	22.3	34.0	6.5	14.6	5.8	3.5	0.2	109.2	3,395

Source: Genscape, EIA, Bloomberg, Platts, BofA Global Research estimates

BofA GLOBAL RESEARCH

Exhibit 294: Acronyms List

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Acronym	Definition
$/bbl	dollars per barrel
1H	first half (of a year)
1Q	first quarter
2H	second half (of a year)
2Q	second quarter
3Q	third quarter
4Q	fourth quarter
AEL	alkaline electrolysis
AFC	alkaline
ARA	Amsterdam, Rotterdam, Antwerp
AUM	assets under management
avg	average
b/d	barrels per day
bbl	barrel
bcf	billion cubic feet
Bcm	billion cubic meters
BMS	battery management system
bn	billion
boe	barrel of oil equivalent
Btu	British thermal unit
bu	bushel
C	Celsius
CAISO	California Independent System Operator
capex	capital expenditure
CB	central bank
CBAM	Carbon Border Adjustment Mechanism
CBO	Congressional Budget Office
CBOT	Chicago Board of Trade
CCA	California Carbon Allowances
CCP	Chinese Communist Party
CDD	cooling degree days
CdTE	cadmium telluride
CDU	crude distillation unit
chge	change
CIF	cost, insurance freight
CIGS	copper indium selenide
CME	Chicago Mercantile Exchange
CPI	consumer price index
Ct	carat
DCF	discounted cash flow
DRC	Democratic Republic of Congo
EA	East Asia
EBOB	European blendstock for oxygenate blending
ECB	European Central Bank
EIA	Energy Information Administration
EM	European market
EPA	Environmental Protection Agency
ESG	environment, social, and governance
ETS	European Trading Scheme
EU	European Union
EUA	European Union Allowance
EUAs	European Union Allowances
EUR	Euro
EV	electric vehicle
FCC	Federal Communications Commission
FeNi	ferro nickel
FOB	free on board
FY	fiscal year
G20	Group of 20
GDP	gross domestic product
GFC	Global Financial Crisis

Exhibit 294: Acronyms List

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Acronym	Definition
GHG	greenhouse gases
GW	gigawatt
GWh	gigawatt hours
HCC	hard coking coal
HDD	heating degree day
HDPE	High Density Polyethylene
HH	Henry Hub
HPR	home purchasing restrictions
HPR	holding period return
HRC	hot-rolled coil
HSFO	high sulphur fuel oil
ICEV	internal combustion engine vehicle
IEA	International Energy Agency
IIJA	Infrastructure Investment and Jobs Act
IMF	International Monetary Fund
IMO	International Maritime Organization
IRA	Inflation Reduction Act
ISO	Independent System Operator
JKM	Japan Korea Marker
JPY	Japanese Yen
kW	kilowatt
L-48	Lower 48 (of the US)
lb	pound
LBMA	London Bullion Market Association
LCOE	levelized cost of energy
lhs	left hand side
LME	London Metal Exchange
LNG	liquified natural gas
LPG	liquified petroleum gas
LSFO	Low sulfur fuel oil
LT	long term
M&A	mergers and acquisitions
m/s	meters per second
MA	moving average
mcm	million cubic meters
ME	Middle East
Mfg	manufacturing
MIFT	metals important for future technology
MISO	Midcontinent Independent System Operator
mmbtu	metric million British thermal unit
mn	million
MOHURD	Ministry of Housing and Urban-Rural Development
MoM	month over month
mph	miles per hour
MSR	Market Stability Reserve
mt	metric ton
Mtpa	million tonnes per anum
MW	megawatt
MWh	megawatt hours
NA	North America
NAV	net asset value
NBS	National Bureau of Statistics of China
NFRA	National Administration of Financial Regulation
ngl	natural gas liquids
NPI	nickel pig iron
NREL	Natural Renewable Energy Laboratory
NWE	North west Europe
NYH	New York Harbor
O&M	operations and maintenance
OECD	Organisation for the Economic Cooperation and Development
OPEC	Organization of the Petroleum Exporting Countries

Exhibit 294: Acronyms List

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Acronym	Definition
OPEC+	OPEC countries plus ten additional countries
Opex	operating expense
OTC	over-the-counter
oz	ounce
PADD	Petroleum Administration for Defense Districts
PBOC	People's Bank of China
PCR	Price Containment Reserve
PDH	propane dehydrogenation
PEM	proton membrane exchange
PGM	platinum group metals
PMI	purchasing managers index
PV	photovoltaic
QoQ	quarter over quarter
RBOB	Reformulated blendstock for oxygenate blending
RD	renewable diesel
Res/Com	residential commercial (demand)
RFS	Renewable Fuel Standard
rhs	right hand side
RIN	Renewable Identification Number
RVO	Renewable Volume Obligation
SAF	sustainable aviation fuel
SHFE	Shanghai Futures Exchange
SOFC	solid oxide
SPR	Strategic Petroleum Reserve
SPUT	Sprott Physical Uranium Trust
SWU	separative work unit
t	ton
TC	treatment charge
Tcf	trillion cubic feet
TMX	Transmountain Expansion Pipeline
TNAC	Total Number of Allowable Credits
TSA	Transportation Security Administration
TTF	Dutch TTF
TWh	terrawatt hours
UAE	United Arab Emirates
UKA	UK allowances
US	United States
USD	US dollar
USDA	US Department of Agriculture
USGC	US Gulf Coast
VLEC	very large ethane carrier
VLSFO	very low sulphur fuel oil
W/m2	watts per meter squared
WCI	Western Climate Initiative
WTI	West Texas Intermediate
yoy	year over year
yr	year
ytd	year to date

Source: BofA Global Research

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