Metals Outlook 2024

Better days ahead

Nicholas Snowdon
+44(20)7774-5436 |
nicholas.snowdon@gs.com
Goldman Sachs International

Aditi Rai
+44(20)7774-5179 | aditi.rai@gs.com
Goldman Sachs International

Lavinia Forcellese
+44(20)7774-9243 |
lavinia.forcellese@gs.com
Goldman Sachs International

Positive inflexion. For most of 2023, industrial metals have been trapped in a balanced bear market. The ex-China surplus generated by the rates-induced manufacturing downturn, reinforced by persistent destocking, has counteracted tightening from robust China demand. A heavy price environment has resulted, with the S&P GSCI Industrial Metals index falling 6% YTD. Going into 2024, while an immediate wholesale change in dynamics is unlikely, we expect a persistent tightening bias from a combination of policy-underpinned China demand and a troughing in DM demand set against, in the most part, progressively greater supply binds. These factors should support a positive inflexion in sector performance (GSe +18% 12M target), centred on upside in aluminium ($2,600/t 12M target) and copper ($10,000/t 12M target), with modest offset from nickel downside ($15,000/t 12M target vs $16,000/t previously).

China's green policy 'put'. The most supportive fundamental this year has been China's surging metal demand, supported by the green economy, grid and property completions. Yet domestic destocking and supply strength, alongside rates-constrained trader activity, have limited an equivalent import uplift. However, given our economists' expectation for a policy-put-underpinned growth path, and now negligible onshore stocks, China's metal import pull will likely be stronger ahead. That applies to metals in particular, given domestic smelting restraints (aluminium, zinc) and lack of inventory cover (copper). Into H1-2024, China should remain a powerful offset to the drag elsewhere, limiting left-tail price risk in our view.

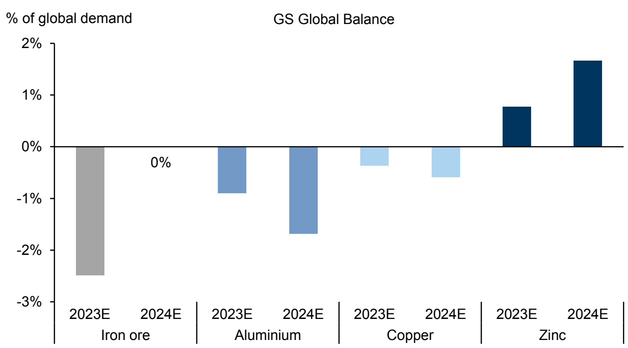
Waiting on Western destocking. The drag from DM end-demand deterioration, exacerbated by destocking, has been the most significant softening effect. Indeed, there is little immediate evidence of a turn in this dynamic, with persistent sluggish spot physical conditions. Nonetheless, a fade in the destocking effect should provide a positive adjustment, which our economists expect to support the manufacturing cycle back to firming trend growth. Evidence of a troughing in European PMIs so far in Q4 is encouraging in this respect. The elevated DM rates environment will restrain capital-intensive demand segments, though base effects and emerging green demand suggest now is peak contraction. Once DM demand growth returns, something we forecast in our base case from mid-2024, stickier more substantive price upside is likely.

Supply binds differentiate. In this demand environment, relative supply conditions will be decisive for the price path. Aluminium is seeing the most immediate bind from China's capacity cap and winter cuts, offering the most supportive setup. Copper's final gasp of mine supply growth in H1-2024 – if achieved – would be a tightening limitation, though the transition then to peak output should eventually support scarcity pricing. Iron ore's limited supply growth and stock buffers leave it vulnerable to tightening surprises. Conversely, surging nickel and lithium supply suggest price downside will be required. This underpins a continuation in our favoured basket trade expressions for industrial metals (long aluminium and copper vs. short nickel and zinc) and short battery metals (lithium, nickel, cobalt).

Gold's shine is returning. We see an environment developing for gold with a fattening in right-tail price risk into next year. The potential upside in gold prices will be closely tied to US real rates and dollar moves, but we also expect persistent strong consumer demand from China and India, alongside central bank buying to offset downward pressures from upside growth surprises and rate cut repricing. On net, we would expect any sell-offs to be limited in scale due to a dovish Fed, slowing wage growth, and resilient central bank purchases. Tactically, we would view a sell-off in gold as a buying opportunity, as we see an environment with elevated risk channels ahead playing into gold's hedge qualities. We maintain our 12M gold target at $2050/toz, albeit with risks skewed to the upside.

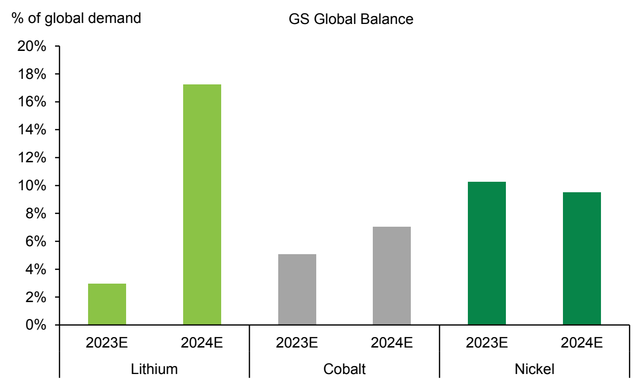
Metals Outlook in 14 charts

Exhibit 1: Aluminium and copper continue to see a significant tightening path in balances into mid-decade...



Source: Goldman Sachs Global Investment Research, Woodmac, BNEF, Fastmarkets, SMM

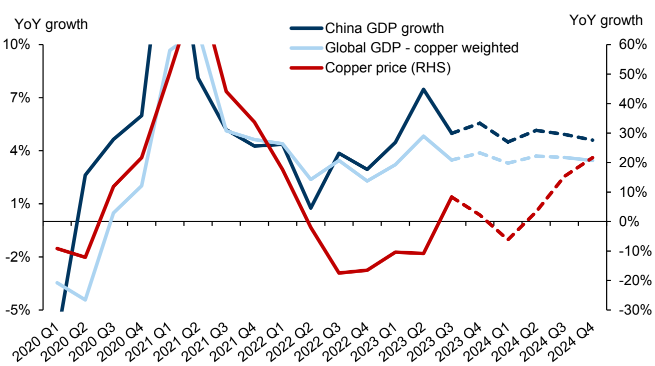
Exhibit 2: ...While surging supply leaves battery raw materials facing multi-year gluts ahead



Source: Goldman Sachs Global Investment Research, Woodmac, BNEF, Fastmarkets, SMM

Exhibit 3: Policy-'put'-underpinned China growth path into next year suggests better support for metals pricing than currently discounted

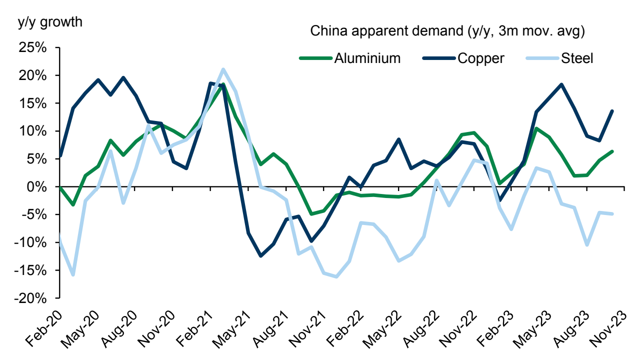
GSe from 2023 Q4



Source: Goldman Sachs Global Investment Research, CRU, Woodmac

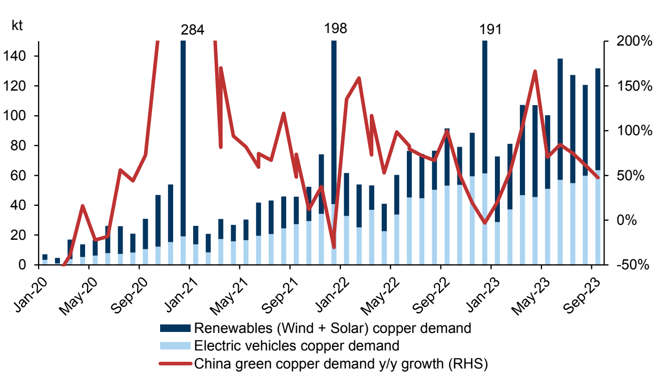
Exhibit 4: Chinese metals demand has moved sharply higher so far this year, nearly double our initial expectations

GSe China apparent demand



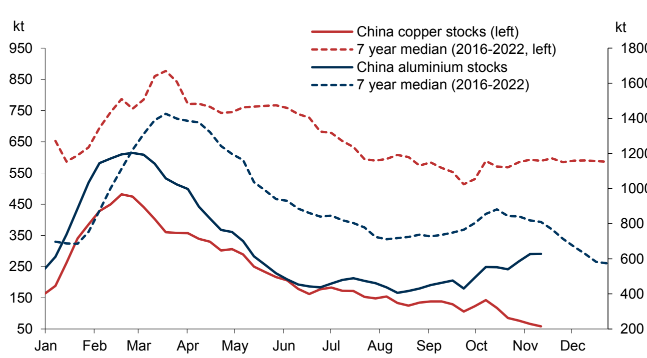
Source: Wind, SMM, Goldman Sachs Global Investment Research

Exhibit 5: Surging green demand remains a cornerstone support for this onshore metals demand strength



Source: Goldman Sachs Global Investment Research, Wind

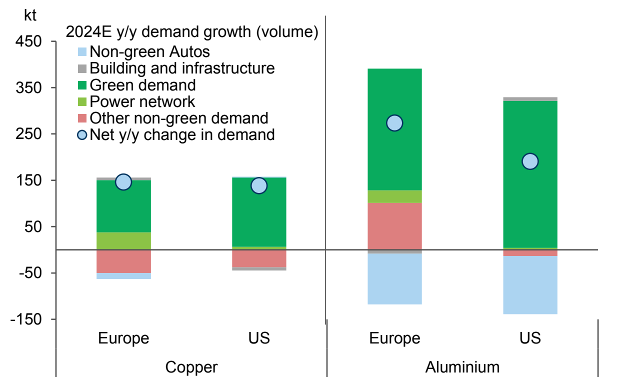
Exhibit 6: Visible metal stock cover has fallen sharply in China since February peak, which suggests Chinese demand has remained strong despite destocking headwinds



Source: Goldman Sachs Global Investment Research, Wind, Bloomberg, SMM

Exhibit 7: Green demand to be the main driver for DM copper and aluminium demand in 2024

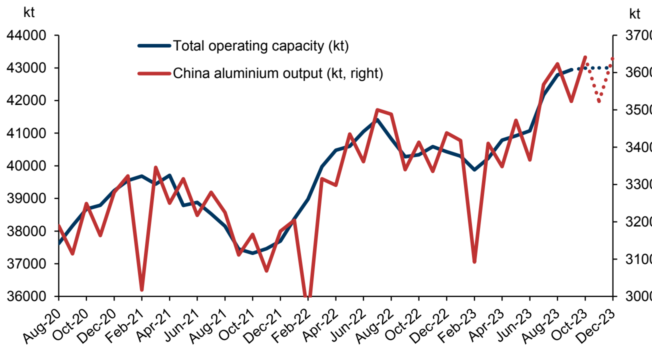
GSe 2024 copper and aluminium demand



Green demand is a sum of renewables, electric vehicles and charging infrastructure sectors.

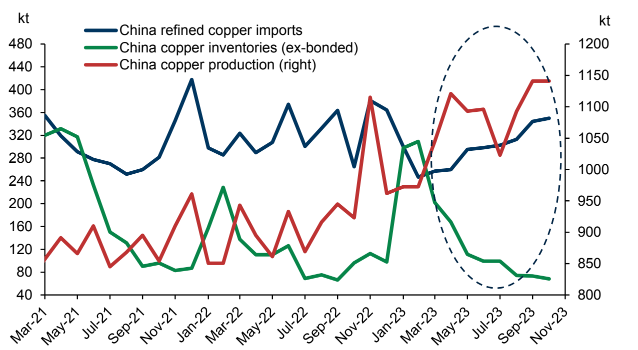
Source: Goldman Sachs Global Investment Research

Exhibit 8: China's capacity cap has now been hit, generating a severe bind on aluminium supply, and elevates tightening risk into 2024



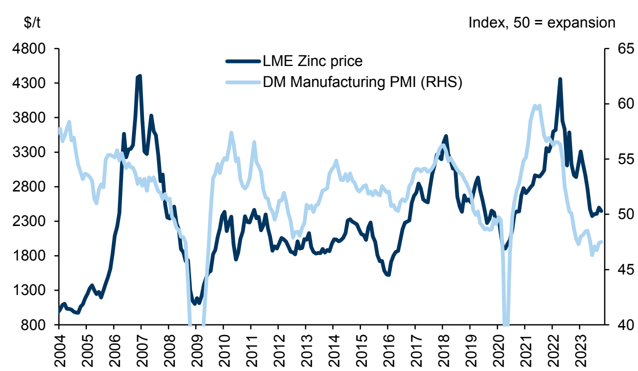
Source: Goldman Sachs Global Investment Research, SMM

Exhibit 9: For copper, with China now destocked of cathode, progessive supply retraints will quickly feed into higher metal imports and LME pricing



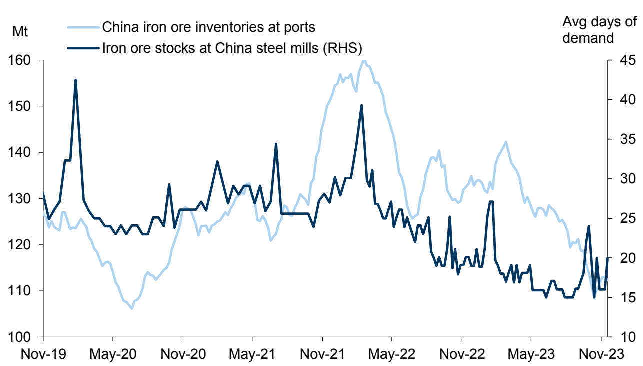
Source: Goldman Sachs Global Investment Research, Wind

Exhibit 10: For zinc, a turn in Western industrial demand will be essential to support a price level, otherwise a small metals surplus suggests rangebound trading ahead



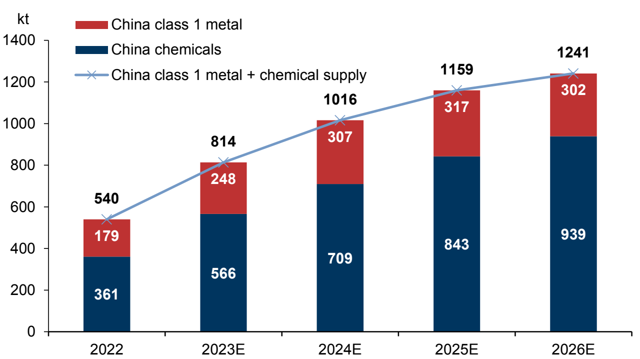
Source: Goldman Sachs Global Investment Research, Haver Analytics

Exhibit 11: Iron ore market remains acutely vulnerable to any tightening surprises given extremely low onshore inventory



Source: Wind, Goldman Sachs Global Investment Research

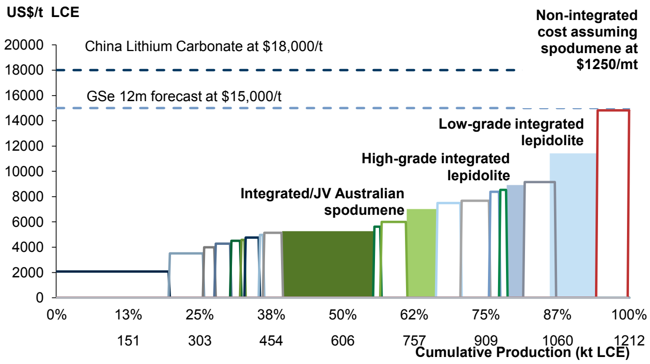
Exhibit 12: For nickel, surging China refined and sulphate supply over the next 3 years points to sustained oversupply and need for lower prices



Source: Goldman Sachs Global Investment Research, Woodmac, Bloomberg

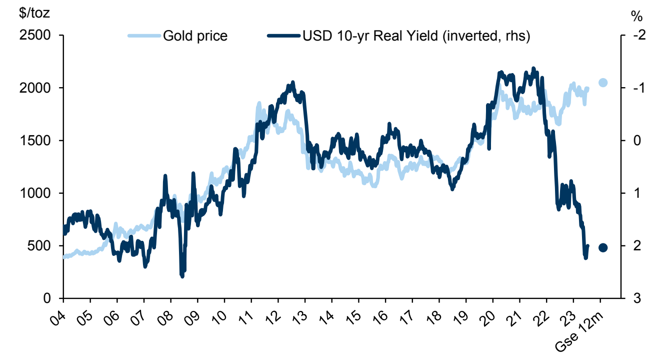
Exhibit 13: Similar for lithium - persistent supply-driven surplus means prices will need to trade deeply into the cost curve into next year

2024 cost curve, excluding royalties and VAT



Source: Goldman Sachs Global Investment Research, Data compiled by Goldman Sachs Global Investment Research, Woodmac

Exhibit 14: The next leg higher in gold prices will require a significant move lower in real rates and the dollar

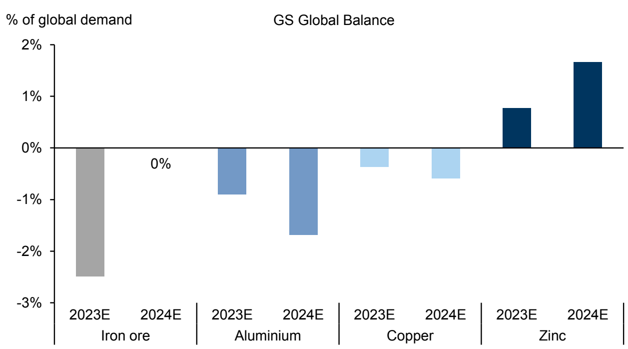


Source: Goldman Sachs Global Investment Research, Bloomberg

Better days ahead

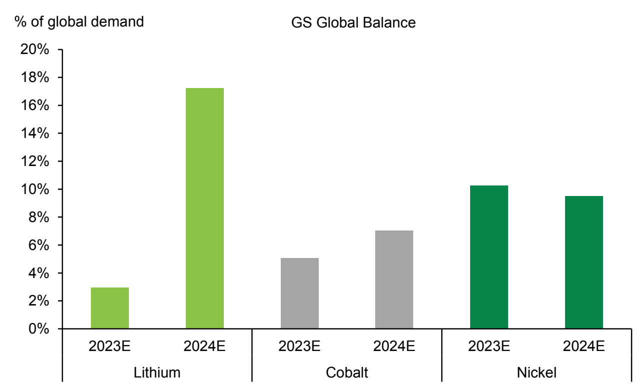
1. Positive inflexion. For most of 2023, industrial metals have been trapped in a balanced bear market. The ex-China surplus generated by the rates-induced manufacturing downturn, reinforced by supply chain destocking, has counteracted tightening from healthy China demand. Heavy price setting has resulted in the S&P GSCI Industrial Metals index falling 6% YTD, albeit differentiated by relative supply conditions limiting downside in aluminium (-6%) and copper (flat) versus greater downside in other metals (nickel -44%). Going into 2024, while an immediate wholesale change in dynamics is unlikely, we expect a persistent tightening bias from a combination of three key supportive market elements compared with this year: (1) ongoing China policy easing underpinning a resilient green-tinted onshore metals demand environment, with reduced stock buffers supporting higher metal imports, (2) a stabilisation in Western metals demand tied to an end in the destocking cycle and rising green consumption, and (3) more significant supply binds due to a depleting growth pipeline as well as margin-related supply rationing effects. In this context, we expect a positive return for industrial metals over the next 12 months (GSe +17.8%) centred on upside in aluminium ($2,600/t 12M target) and copper ($10,000/t 12M target) with offset from nickel downside ($15,000/t 12M target vs. $16,000/t previously) in particular.

Exhibit 15: Aluminium and copper continue to see a significant tightening path in balances into mid-decade...



Source: Goldman Sachs Global Investment Research, Woodmac, BNEF, Fastmarkets, SMM

Exhibit 16: ..While surging supply leaves battery raw materials facing multi-year gluts ahead



Source: Goldman Sachs Global Investment Research, Woodmac, BNEF, Fastmarkets, SMM

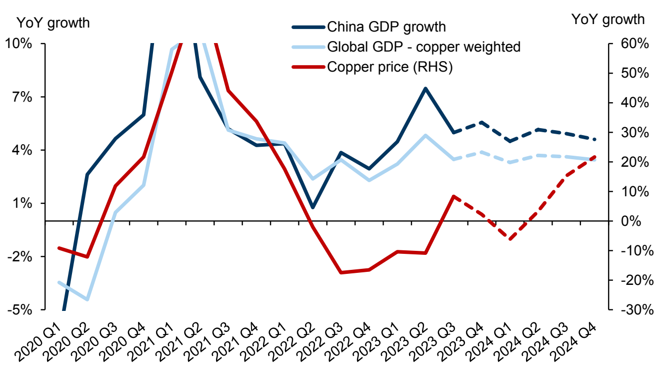
Exhibit 17: GS metals price and balance forecast

	GS Price Forecast				GS Global Balance (kt)	
Metal	**3m**	**6m**	**12m**	**2024E**	**2023E**	**2024E**
LME Aluminum ($/mt)	2,300	2,400	2,600	2,500	-634	-1227
LME Cobalt ($/mt)			28,000	30,000	10	15
LME Copper ($/mt)	8,400	8,850	10,000	9,200	-93	-155
LME Nickel ($/mt)	16,000	15,000	15,000	16,000	318	328
LME Zinc ($/mt)	2,450	2,575	2,600	2,550	107	236
SGX Iron Ore ($/mt)	130	120		110	-39	0
China Spot Lithium Carbonate ex VAT ($/t)			15,000	13,377	29	202
COMEX Gold ($/troy)	2,050	2,050	2,050		--	--

Source: Goldman Sachs Global Investment Research

2. China's green policy 'put'. One of the outstanding features of industrial metals markets this year has been China's metals demand outperformance for the aggregate industrial economy. Onshore demand for aluminium (+5% y/y ytd vs. GSe +4.4% y/y Jan'23) and copper (+12% y/y ytd vs. GSe +6% y/y Jan'23) has been exceptionally strong through the course of this year. This has been rooted in the rapid growth in the metals-intensive green economy (renewables, EVs), as well as related investment in grid upgrade, with some non-green support also from elevated property completions supported by the destock of previously delayed new projects. While this effect alone has clearly not been enough to generate significant global deficits this year, it has nonetheless prevented a rebuild in market inventory buffers and the related ongoing trend higher in China's metals imports is now offsetting the ex-China demand drag. Importantly, as our economists have recently emphasised, more significant policy support is anticipated into 2024. This should underpin growth in metals-intensive manufacturing and infrastructure investment. In this context, we continue to expect a resilient China green metals demand environment with a strong existing pipeline (solar projects and EV production plans) to be further supplemented ahead. This should support only a modest deceleration in China metals demand next year (GSe +3% average). At least in H1-2024, China will remain an offset to the drag elsewhere before broader competition and price support emerge later in the year.

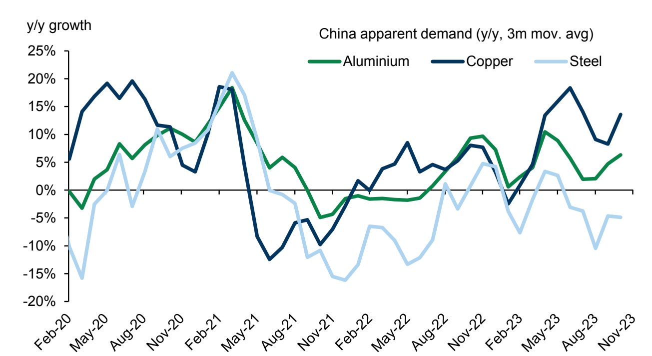
Exhibit 18: Policy-'put'-underpinned China growth path into next year suggests better support for metals pricing than currently discounted



Source: Goldman Sachs Global Investment Research, Woodmac, CRU

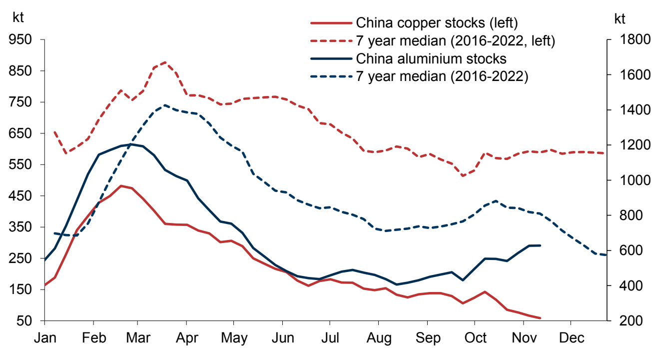
Exhibit 19: China's apparent demand for aluminium and especially copper has grown at robust rates despite macro worries

GSe China apparent demand



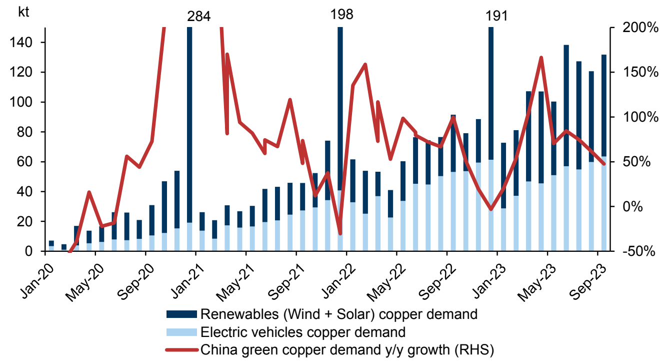
Source: Wind, SMM, Goldman Sachs Global Investment Research

Exhibit 20: Visible metal stock cover has fallen sharply in China since February peak, which suggests Chinese demand has remained strong despite destocking headwinds



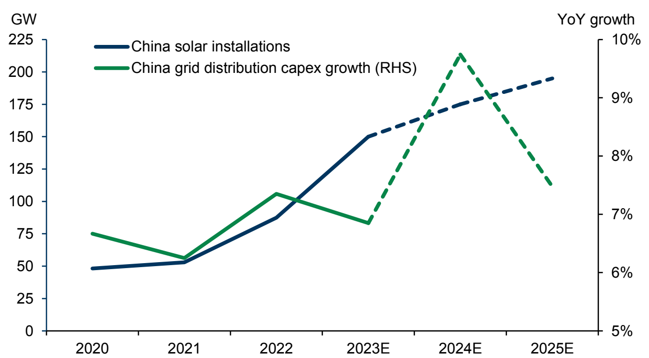
Source: Goldman Sachs Global Investment Research, Wind, Bloomberg, SMM

Exhibit 21: Surging green demand remains a cornerstone support for onshore copper consumption



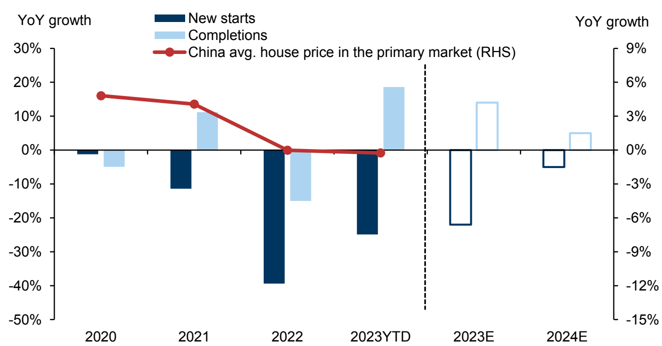
Source: Goldman Sachs Global Investment Research, Wind

Exhibit 22: In our view, China green-tinted demand channel will act as a firm limitation on metals downside



Source: Goldman Sachs Global Investment Research

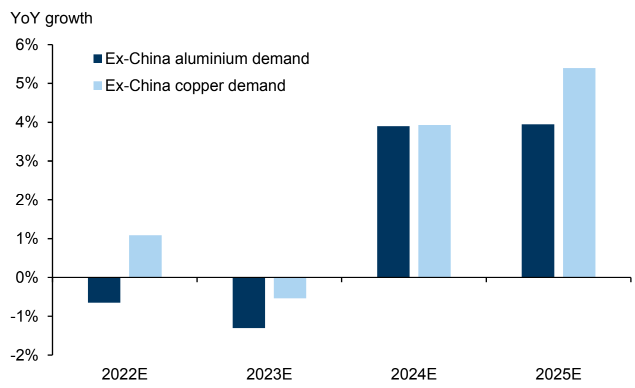
Exhibit 23: Property completion growth and less drag from new starts would be supportive into next year, on project destocking and policy support



Source: Goldman Sachs Global Investment Research, NBS

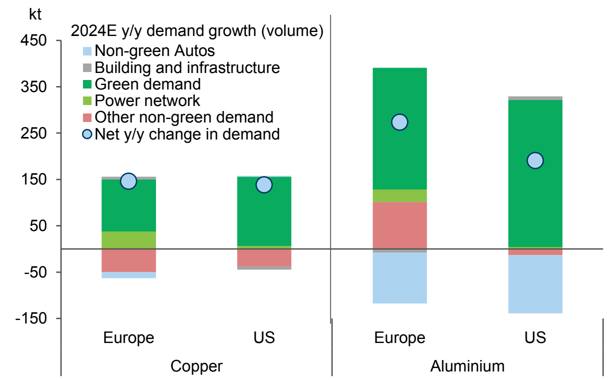
3. Waiting on Western destocking. The drag from ex-China end-demand deterioration, exacerbated by supply chain destocking, has been the most significant softening effect on metal fundamentals this year. We estimate ex-China metals end-demand has on average contracted 1% this year, though midstream supply chain destocking means that the physical apparent demand contraction has been greater (5-10%). On immediate inspection, there is little evidence of an inflexion in these trends – Western metals premia remain pressured, spot market activity limited and order books into next year light. Nonetheless, we expect a more positive path ahead for ex-China demand, with an average +3% growth across our covered metals next year. This recovery trajectory is rooted in three key factors. First, we expect a fade in the destocking effect to provide a positive adjustment, which our economists see supporting a convergence in the manufacturing cycle back to firming trend growth. Evidence already suggests that the destocking cycle has matured in the US, though it will likely persist in Europe until H1 next year. Second, we also anticipate more significant growth in green demand channels across the ex-China demand side, tied to growth in the DM EV sales volume (+1.7mil units, 35% y/y) and solar installations (+15GW, +15% y/y) in particular. Third, while there will likely remain a drag from capital-intensive segments such as building and construction, we also expect resilience in auto production. This is tied to continued growth in EV uptake and supply-chain rebalancing. However, until growth returns to DM metals demand, something we forecast in our base case from H2 next year, broad bullish price momentum is unlikely.

Exhibit 24: A fade in destocking effect should provide a positive adjustment to ex-China metals demand into H2-'24



Source: Goldman Sachs Global Investment Research

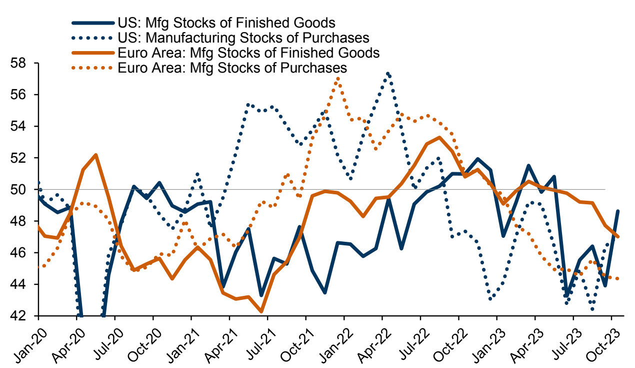
Exhibit 25: Green demand to remain the main driver for copper and aluminium demand in 2024
GSe 2024 copper and aluminium demand



Green demand is a sum of renewables, electric vehicles and charging infrastructure sectors.

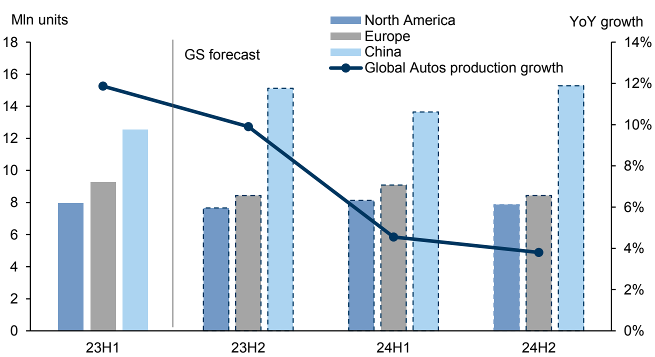
Source: Goldman Sachs Global Investment Research

Exhibit 26: DM inventory destocking cycle is troughing and should support manufacturing activity next year
Manufacturing PMI subcomponents



Source: Haver Analytics, Goldman Sachs Global Investment Research

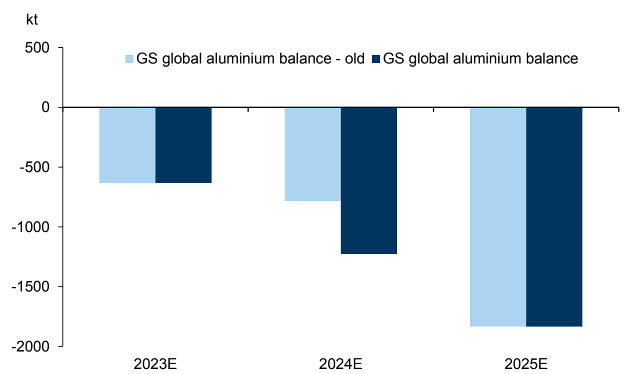
Exhibit 27: Our auto analysts expect global auto production to remain in expansion for the next year



Source: Goldman Sachs Global Investment Research, S&P Global

4. Aluminium: Increasing tightness on China's supply bind. Aluminium has spent much of the past year trapped in a depressed equilibrium between destocking-exacerbated DM demand headwinds and an uplift in China import demand. This has left the global primary market in a modest deficit this year (GSe 634kt deficit), visible stocks close to flat YTD (now totaling 1.1Mt) and LME prices down modestly (-6% YTD). As we look into 2024, we expect a larger full-year global primary deficit (GSe 1.2Mt vs. 784kt deficit previously), albeit split between a 1.6Mt deficit in China and 370kt surplus in ex-China. The tightening increment reflects primarily the impact of China's supply bind, where a combination of hitting the capacity cap and Yunnan winter cuts means that onshore primary production will likely only grow 2% next year and peak in 2025. The key implication of this stagnating supply path is that, even with a moderation in onshore demand growth, China's balance is moving into more significant deficits ahead (GSe 1.6Mt in 2024, 1.5Mty in 2025 vs. 1.1Mt in 2023) and, as such, more sizeable metal import requirements. Given our expectation for a trough in ex-China demand (GSe +4% y/y in 2024 vs. -1% y/y in 2023), reinforced by less physical drag from DM destocking, the market should ultimately transition towards greater competition for units and support for higher prices over the course of next year. Visible primary aluminium inventories remain low (just 1.1Mt), which is smaller than our expected global deficit next year, suggesting that prices will need to rise to support ex-China producer margins (with 2.5Mty currently loss-making). Overall, we continue to target upside in the aluminium LME price with 3/6/12M targets of $2,300/2,400/2,600/t.

Exhibit 28: No respite from deficit conditions into 2024 as Chinese capacity cap approaches
GS primary aluminium balance

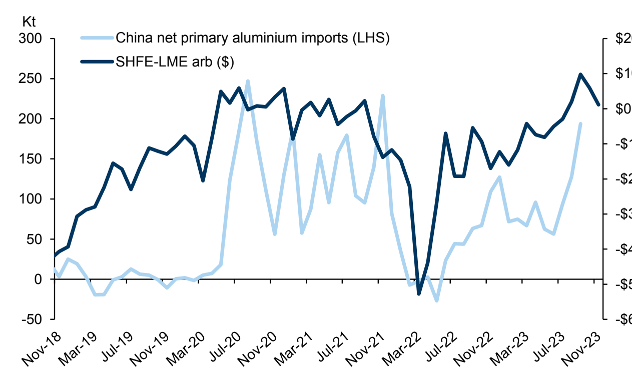


Source: Goldman Sachs Global Investment Research, IAI, CRU, Woodmac

Exhibit 29: China's primary metal imports have already increased sharply, without domestic stocks rising

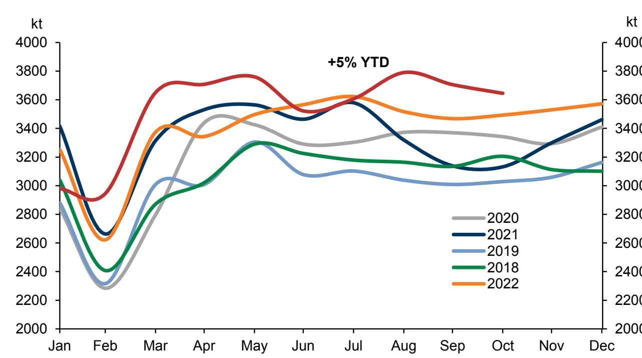
Source: Goldman Sachs Global Investment Research, Wind, SMM

Exhibit 30: Open import arb into China suggests that metal imports will remain strong into year-end and potentially into Q1-24



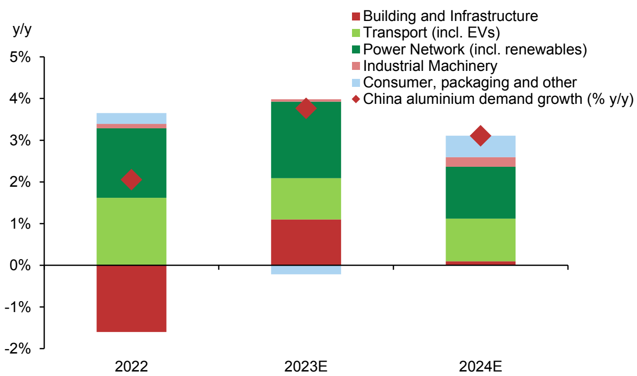
Source: Goldman Sachs Global Investment Research, Bloomberg, Wind

Exhibit 31: Supply constraints are playing out in an environment of healthy onshore aluminium demand, which has risen 5% y/y ytd



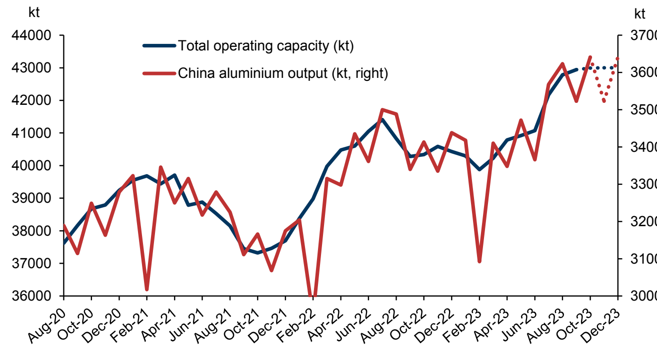
Source: Goldman Sachs Global Investment Research, SMM, Wind

Exhibit 32: Chinese aluminium demand continues to benefit from robust green demand drivers, likely continuing into next year



Source: Goldman Sachs Global Investment Research, Woodmac

Exhibit 33: China's capacity cap has now been hit, generating a severe bind on aluminium supply, and elevates tightening risk into 2024



Source: Goldman Sachs Global Investment Research, SMM

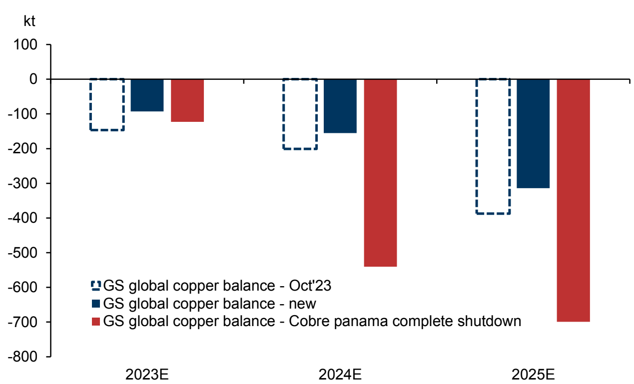
Exhibit 34: GS Global Aluminium SD Model

('000 tonnes)	2016	2017	2018	2019	2020	2021	2022E	2023E	2024E	2025E
Consumption - DM										
US	5490	5542	5672	5480	4930	5483	5661	5559	5750	5948
% change y/y	*2%*	*1%*	*2%*	*-3%*	*-10%*	*11%*	*3%*	*-2%*	*3%*	*3%*
Europe	8606	8718	8712	8734	7811	8615	8639	8394	8668	9056
% change y/y	*3%*	*1%*	*0%*	*0%*	*-11%*	*10%*	*0%*	*-3%*	*3%*	*4%*
Japan	2080	2137	2099	2064	1879	2071	2012	1987	2093	2147
% change y/y	*3%*	*3%*	*-2%*	*-2%*	*-9%*	*10%*	*-3%*	*-1%*	*5%*	*3%*
Other DM	3088	3141	3046	3058	2842	3177	3117	3132	3254	3403
% change y/y	*3%*	*2%*	*-3%*	*0%*	*-7%*	*12%*	*-2%*	*0%*	*4%*	*5%*
Sub- DM	19264	19538	19529	19336	17461	19346	19429	19072	19764	20555
% change y/y	*3%*	*3%*	*1%*	*-3%*	*-9%*	*11%*	*0%*	*-2%*	*4%*	*4%*
Consumption - EM										
China	31664	34283	35612	36265	38384	40014	40836	42374	43691	44279
% change y/y	*8%*	*9%*	*4%*	*1%*	*7%*	*4%*	*2%*	*4%*	*3%*	*1%*
Other EM	8874	9162	9071	9200	8707	9450	9181	9163	9571	9937
% change y/y	*3%*	*3%*	*-1%*	*1%*	*-5%*	*9%*	*-3%*	*0%*	*4%*	*4%*
Sub- EM	40538	43445	44683	45466	47092	49465	50017	51537	53262	54215
% change y/y	*7%*	*7%*	*3%*	*2%*	*4%*	*5%*	*1%*	*3%*	*3%*	*2%*
Global Consumption	59802	62983	64212	64801	64553	68811	69446	70609	73025	74771
% change y/y	*5%*	*6%*	*3%*	*-1%*	*0%*	*7%*	*1%*	*2%*	*3%*	*2%*
Global Production										
China Production	32306	35843	36379	35476	37049	38691	40079	41283	42095	42800
% change y/y	*5%*	*11%*	*2%*	*-3%*	*4%*	*4%*	*4%*	*3%*	*2%*	*2%*
Ex-China Production	26815	27219	27608	27982	28071	28962	28570	28693	29704	30136
% change y/y	*2%*	*2%*	*1%*	*1%*	*0%*	*3%*	*-1%*	*0%*	*4%*	*1%*
Total Production	59121	63061	63987	63458	65120	67653	68648	69976	71799	72936
% change y/y	*3.4%*	*6.7%*	*1.5%*	*-0.8%*	*2.6%*	*3.9%*	*1.5%*	*1.9%*	*2.6%*	*1.6%*
Global Balance	**-681**	**78**	**-225**	**-1344**	**568**	**-1158**	**-797**	**-634**	**-1227**	**-1835**
Cash Prices (annual average)										
Current Dollars ($/t)	1607	1975	2114	1808	1723	2482	2710	2300	2500	5000

Source: Goldman Sachs Global Investment Research, IAI, CRU, Woodmac

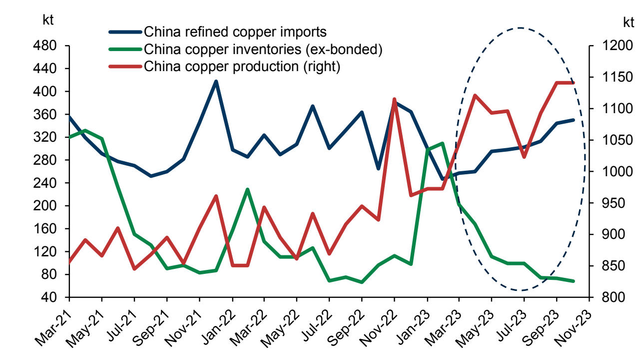
5. Copper: Balancing supply headwinds, green tailwinds. Copper has spent much of the past year trading in a narrow range in the mid-low $8,000s, just above the top of the cost curve. This has, in turn, reflected a tightly balanced market with low inventory cover (GSe 93kt deficit in 2023 vs. 147kt deficit previously). That has reflected an environment of offsetting fundamental surprises, with significantly stronger China demand than widely expected, offset by weaker ex-China demand and stronger China refined output. As we look into 2024, we expect a modest tightening in the aggregate refined balance (GSe 155kt), though this should generate more significant visible tightening effects given less destocking flex. As we have highlighted previously, concentrate destocking has led to the significant refined supply outperformance of mine supply so far in 2023. Our base case mine supply path for next year (GSe +5% vs +2% in 2023) suggests that at least during H1-2024 there will be enough concentrate availability to support continued strength in refined production to limit cathode tightness. There remains elevated risk that disruptions on the mine supply side could curtail that supply path, and with global mine supply set to peak over 2025-26, there is ultimately a firm supply bind on a 12M horizon. On demand, while we expect a deceleration in China's copper demand growth rate next year (GSe +2% y/y vs. +5% y/y in 2023), the ongoing policy easing support onshore suggests there is right-tail risk to this assumption. Equally, our expectation for a recovery in ex-China demand (Gse +4% y/y vs. -1% y/y in 2023) remains vulnerable to left-tail risk if the expected bottom in industrial production fails to materialise. Nonetheless, with visible copper inventories at 260kt – just 4 days of demand cover – as the metal pivots into more significant tightness from H2 next year, we expect a particularly sharp repricing to the upside. In this context, we continue to target accelerating upside in the copper LME price, with 3/6/12M targets of $8,400/8,850/10,000/t.

Exhibit 35: An extended suspension of Cobre Panama could potentially move the copper market to scarcity conditions next year
GS global copper balance



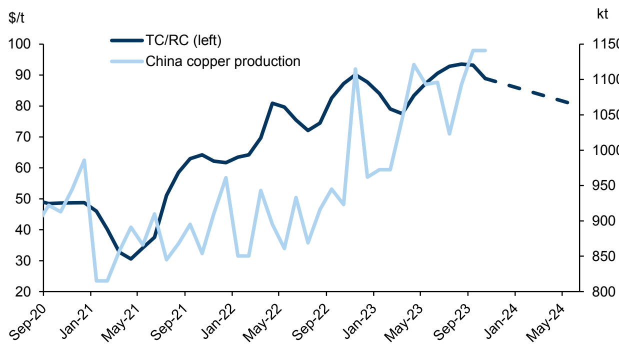
Source: Goldman Sachs Global Investment Research

Exhibit 36: With China now destocked of cathode, progessive supply retraints will quickly feed into higher metal imports and LME pricing



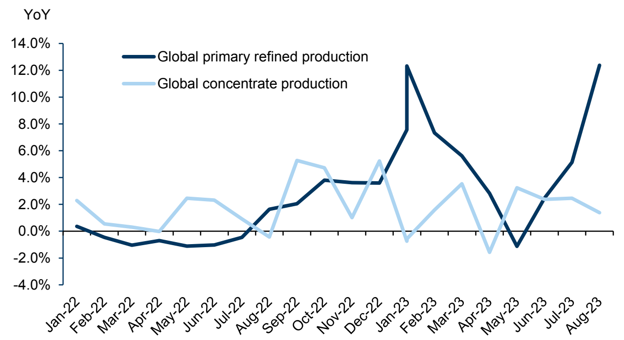
Source: Goldman Sachs Global Investment Research, Wind

Exhibit 37: Turn lower in TC/RCs suggests more constrained concentrate availability on China's refined production path



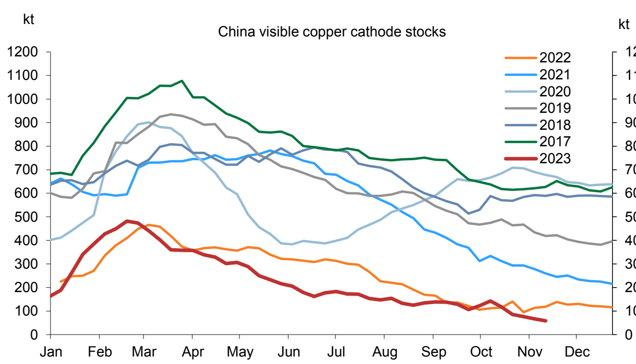
Source: Goldman Sachs Global Investment Research, SMM, Wind

Exhibit 38: A potential faltering in mine supply would tighten the availability of concentrate needed to sustain the current strong trend in refined production



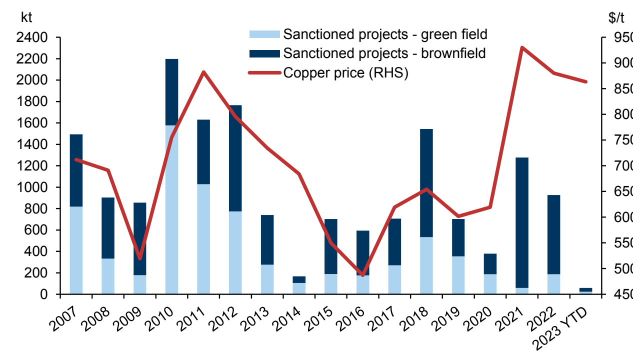
Source: Goldman Sachs Global Investment Research, ICSG

Exhibit 39: China's cathode inventories are now at record low levels of demand cover, drawing destocking to an end



Source: Goldman Sachs Global Investment Research, Wind, SMM, Bloomberg

Exhibit 40: Output from sanctioned copper projects - both greenfield and brownfield - has dropped sharply



2023 Year-to-June data

Source: Woodmac, Goldman Sachs Global Investment Research

Exhibit 41: China's apparent copper demand has risen 10% year-to-September, end-demand also up a healthy 7%, with scrap tightness explaining the difference

	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	YTD y/y	FY y/y GSe
Building & Infrastructure	-18%	-5%	-6%	-6%	-11%	-6%	4%	5%	8%	9%	6%	5%	8%	2%	7%	6%	3%
Power Network	5%	7%	5%	-1%	4%	2%	4%	4%	5%	5%	5%	4%	6%	-5%	6%	4%	3%
Transport - ex EVs	27%	24%	19%	-4%	-23%	-21%	-38%	-1%	-2%	74%	13%	-11%	-17%	-2%	-1%	-4%	-9%
Home Appliances	-8%	16%	3%	-4%	-7%	0%	-19%	68%	22%	34%	31%	32%	26%	-7%	-14%	18%	6%
Machinery	-4%	-6%	-1%	-6%	12%	-13%	-15%	-3%	-12%	-12%	-12%	-15%	-12%	-6%	-7%	-11%	-5%
Non-green copper end-demand	***-5%***	***2%***	***0%***	***-4%***	***-1%***	***-5%***	***-5%***	***11%***	***4%***	***9%***	***5%***	***3%***	***4%***	***-3%***	***0%***	***2%***	***3%***
Solar	39%	64%	132%	50%	35%	8%	88%	88%	466%	299%	89%	140%	174%	137%	94%	145%	58%
Wind	15%	-41%	72%	-31%	-75%	-34%	2%	2%	110%	126%	74%	213%	67%	116%	47%	104%	66%
EVs	117%	105%	94%	83%	74%	50%	-12%	48%	27%	102%	51%	26%	23%	19%	19%	29%	26%
Green copper end-demand	***72%***	***67%***	***100%***	***51%***	***19%***	***-3%***	***20%***	***54%***	***105%***	***167%***	***70%***	***84%***	***75%***	***62%***	***48%***	***71%***	***45%***
China copper end-demand	**0%**	**6%**	**6%**	**-1%**	**0%**	**-5%**	**-4%**	**13%**	**10%**	**20%**	**10%**	**9%**	**9%**	**2%**	**3%**	**7%**	**5%**
China copper apparent demand	**3%**	**6%**	**7%**	**11%**	**5%**	**-6%**	**-6%**	**15%**	**5%**	**20%**	**23%**	**12%**	**7%**	**8%**	**10%**	**10%**	**-**

Source: Goldman Sachs Global Investment Research, Wind

Exhibit 42: GS Global Copper SD Model

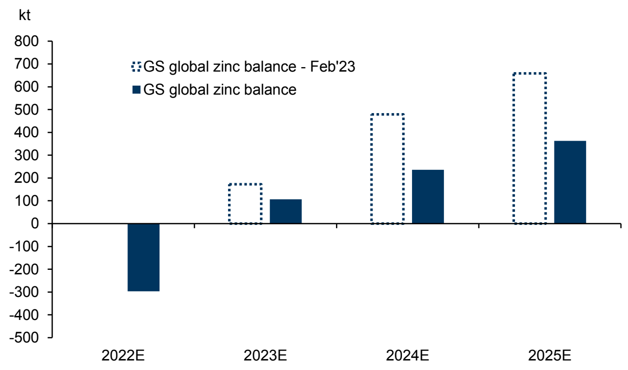
('000 tonnes)	2016	2017	2018	2019	2020	2021	2022E	2023E	2024E	2025E
Consumption - DM										
US	2107	2113	2127	2155	2047	2224	2212	2203	2297	2483
% change y/y	*0.1%*	*0.3%*	*0.7%*	*1.3%*	*-5.0%*	*8.6%*	*-1%*	*0%*	*4.2%*	*8.1%*
Europe	5040	5166	5259	5047	4668	5002	5048	4892	5037	5273
% change y/y	*0.3%*	*2.5%*	*1.8%*	*-4.0%*	*-7.5%*	*7%*	*1%*	*-3%*	*3%*	*5%*
Japan	1405	1458	1450	1392	1295	1403	1431	1412	1439	1504
% change y/y	*-2.0%*	*3.7%*	*-0.6%*	*-4.0%*	*-7.0%*	*8%*	*2%*	*-1%*	*2%*	*4%*
Other DM	2279	2328	2234	2089	1922	2026	2060	2050	2136	2245
% change y/y	*1.2%*	*2.2%*	*-4.1%*	*-6.5%*	*-8.0%*	*5%*	*2%*	*0%*	*4%*	*5%*
Sub- DM	10831	11065	11069	10683	9933	10655	10751	10558	10910	11505
% change y/y	*0.1%*	*2.2%*	*0.0%*	*-3.5%*	*-7.0%*	*7%*	*1%*	*-2%*	*3%*	*5%*
Consumption - EM										
China	12816	13326	13710	13930	14251	15043	15395	16224	16580	16743
% change y/y	*3.1%*	*4.0%*	*2.9%*	*1.6%*	*2.3%*	*5.6%*	*2.3%*	*5.4%*	*2.2%*	*1.0%*
Other EM	4691	4769	4883	4963	4491	4751	4823	4932	5145	5395
% change y/y	*1.5%*	*1.7%*	*2.4%*	*1.6%*	*-9.5%*	*6%*	*2%*	*2%*	*4%*	*5%*
Sub- EM	17508	18095	18593	18893	18742	19794	20218	21155	21725	22138
% change y/y	*2.7%*	*3.4%*	*2.7%*	*1.6%*	*-0.8%*	*6%*	*2%*	*5%*	*3%*	*2%*
Global Consumption	28338	29160	29662	29576	28674	30450	30968	31713	32634	33643
% change y/y	*1.7%*	*2.9%*	*1.7%*	*-0.3%*	*-3.0%*	*6%*	*2%*	*2%*	*3%*	*3%*
Direct Global Scrap Use	*5756*	*6106*	*6136*	*6047*	*5140*	*5720*	*5654*	*5645*	*5752*	*5925*
Refined Global Consumption	22583	23054	23526	23529	23313	24346	24865	25609	26409	27280
% change y/y	*3.0%*	*2.1%*	*2.0%*	*0.0%*	*0.0%*	*3%*	*2%*	*3%*	*3%*	*3%*
Global Production										
Mine Production	20194	20084	20671	20761	20515	21181	21764	22188	23311	24023
% change y/y	*5.0%*	*-0.5%*	*2.9%*	*0.4%*	*-1.2%*	*3.2%*	*2.8%*	*1.9%*	*5.1%*	*3.1%*
Refined Production	22716	22958	23353	23378	22988	23888	24658	25516	26254	26966
% change y/y	*3.1%*	*1.1%*	*1.7%*	*0.1%*	*-1.7%*	*3.9%*	*3.2%*	*3.5%*	*2.9%*	*2.7%*
Global Balance	**133**	**-96**	**-173**	**-151**	**-326**	**-457**	**-207**	**-93**	**-155**	**-314**
Cash Prices (annual average)										
Current Dollars ($/t)	4870	6192	6540	6017	6194	9300	8693	8689	9200	15000
Current Dollars (c/lb)	221	280	296	272	281	422	394	394	417	680

Source: Woodmac, Goldman Sachs Global Investment Research

6. Zinc: Finding the bottom. We think the market has reached the bottom in zinc prices, with next year's surplus declining due to concentrate supply rationing. Since mid-year several other zinc mine operations (Tara, Aljustrel, Middle Tennessee) have suspended production due to falling prices and cost inflation, bringing c.250kt equivalent of zinc mine supply to a halt. This has tightened the concentrate market, weighing on treatment charges, and restrained onshore refined zinc production, which has contributed to the trend of higher metal imports into China over the past months. This dynamic has played out when zinc demand in China has outperformed expectations and remained strong YTD (+7% year-to-Oct y/y). In our latest supply-demand balance, we now project the refined zinc market to be in a 107kt surplus in 2023 (173kt surplus previously), followed by smaller surplus than previously expected in 2024/25 (see Exhibit 43). The main tightening adjustment has been a lower concentrate supply (Exhibit 44) due to cost-related cuts resulting in our conclusion that this points to a bottom in zinc prices; our new 3/6/12m targets are $2,450/$2,575/$2,600/t (versus $2,250/$2,100/$2,000/t previously). We also lift our full-year average for 2024/25 to

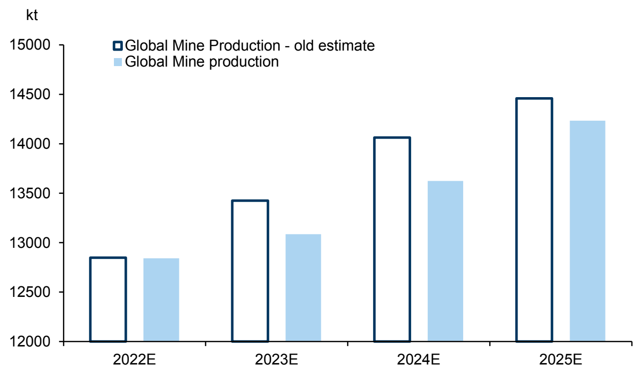
$2550/2650/t (vs $2,100/t for both previously). Nonetheless, more significant supply rationing is needed to generate sustained price upside in the current ex-China demand environment, in our view. Zinc demand does not possess the structural bullish green demand dynamics of copper and aluminium; therefore, a turn in industrial demand – particularly in construction – will be essential to generate sustained upside price action if more material supply cuts do not emerge from here (see Exhibit 46).

Exhibit 43: Refined zinc balance has softened materially due to cost inflation led supply rationing



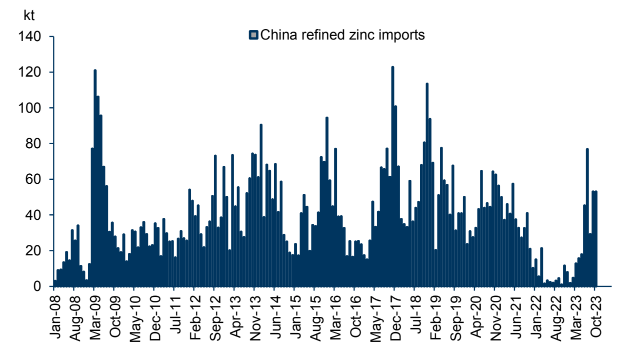
Source: Goldman Sachs Global Investment Research, Woodmac

Exhibit 44: Several other zinc mine operations have suspended production due to low prices and cost inflation bringing c.250kt equivalent of zinc mine supply to a halt



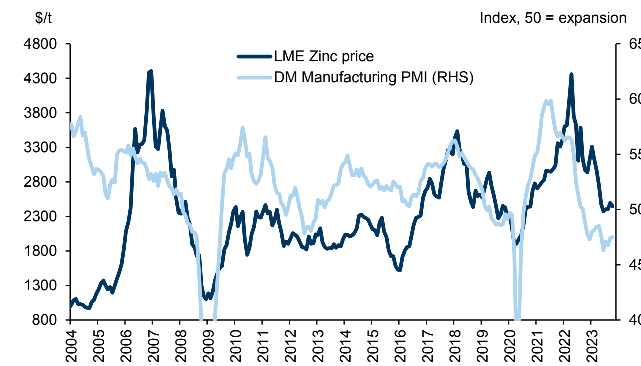
Source: Goldman Sachs Global Investment Research, Woodmac

Exhibit 45: Surging refined zinc imports in China due to healthy demand have also supported prices



Source: Goldman Sachs Global Investment Research, Wind

Exhibit 46: A turn in Western industrial demand will be essential to generate sustained upside price action in absence of further supply cuts



Source: Goldman Sachs Global Investment Research, Haver Analytics

Exhibit 47: GS Global Zinc SD Model

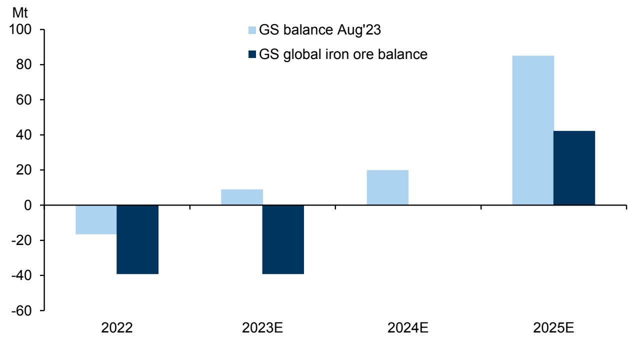
('000 tonnes)	2016	2017	2018	2019	2020	2021	2022E	2023E	2024E	2025E
Consumption - DM										
US	1077	1078	1078	1024	942	1018	1038	1022	1038	1064
% change y/y	*1%*	*0%*	*0%*	*-5%*	*-8%*	*8%*	*2%*	*-2%*	*2%*	*3%*
Japan	450	452	445	427	385	400	392	392	400	410
% change y/y	*1%*	*0%*	*-2%*	*-4%*	*-10%*	*4%*	*-2%*	*0%*	*2%*	*3%*
Western Europe	1932	1956	1920	1824	1624	1754	1710	1658	1675	1725
% change y/y	*1%*	*1%*	*-2%*	*-5%*	*-11%*	*8%*	*-3%*	*-3%*	*1%*	*3%*
Other DM	1502	1524	1486	1461	1315	1407	1378	1365	1406	1448
% change y/y	*1%*	*1%*	*-3%*	*-2%*	*-10%*	*7%*	*-2%*	*-1%*	*3%*	*3%*
Sub- DM	4961	5010	4930	4737	4265	4578	4518	4438	4518	4647
% change y/y	*1%*	*1%*	*-2%*	*-4%*	*-10%*	*7%*	*-1%*	*-2%*	*2%*	*3%*
Consumption - EM										
China	6643	6797	6800	6850	6950	7054	6772	6975	7254	7436
% change y/y	*4%*	*2%*	*0%*	*1%*	*1%*	*2%*	*-4%*	*3%*	*4%*	*3%*
India	685	703	701	673	554	637	650	653	686	716
% change y/y	*8%*	*3%*	*0%*	*-4%*	*-18%*	*15%*	*2%*	*1%*	*5%*	*5%*
Russia	*185*	*186*	*187*	*189*	*185*	*191*	*194*	195	199	202
% change y/y	*0%*	*1%*	*1%*	*1%*	*-2%*	*3%*	*2%*	*1%*	*2%*	*2%*
Brazil	230	230	227	225	203	233	238	239	244	249
% change y/y	*2%*	*0%*	*-1%*	*-1%*	*-10%*	*15%*	*2%*	*1%*	*2%*	*2%*
Other EM	1347	1345	1322	1306	1175	1269	1295	1301	1334	1374
% change y/y	*0%*	*0%*	*-2%*	*-1%*	*-10%*	*8%*	*2%*	*1%*	*3%*	*3%*
Sub- EM	9090	9260	9237	9243	9067	9384	9148	9363	9716	9977
% change y/y	*3%*	*2%*	*0%*	*0%*	*-2%*	*3%*	*-3%*	*2%*	*4%*	*3%*
Global Consumption	14051	14269	14166	13980	13332	13962	13666	13800	14234	14623
% change y/y	*2%*	*2%*	*-1%*	*-1%*	*-5%*	*5%*	*-2%*	*1%*	*3%*	*3%*
Ex-China consumption	7408	7472	7366	7130	6382	6908	6894	6825	6980	7188
% change y/y	*1%*	*1%*	*-1%*	*-3%*	*-10%*	*8%*	*0%*	*-1%*	*2%*	*3%*
Global Production										
Mine Production	12085	12549	12855	12884	12418	12846	12841	13085	13623	14234
% change y/y	*-8%*	*4%*	*2%*	*0%*	*-4%*	*3%*	*0%*	*2%*	*4%*	*4%*
Refined Production (incl DLA)	13586	13523	13247	13400	13734	13908	13370	13907	14470	14986
% change y/y	*-1%*	*0%*	*-2%*	*1%*	*2%*	*1%*	*-4%*	*4%*	*4%*	*4%*
Global Balance	**-466**	**-746**	**-920**	**-580**	**401**	**-54**	**-296**	**107**	**236**	**363**
Cash prices (annual average)										
Current Dollars ($/t)	2099	2890	2900	2522	2276	3007	3440	2652	2550	2650
Current Dollars (c/lb)	95	131	132	114	103	136	156	120	116	120

Source: Goldman Sachs Global Investment Research, Woodmac

7. **Iron Ore: Resilience with a fat right tail.** For much of 2023, iron ore has been seen as the China commodity property short. Yet, the commodity's fundamental and price resilience has defied these expectations. Indeed, rather than facing a surplus for this year, we now expect the iron ore market to be in a clear deficit (GSe 39Mt deficit). While China's steel demand remained in clear contraction, the feed-through into iron ore demand has been limited by outperforming steel production underpinned by a lack of (expected) policy cuts, sustained steel export strength and restrained scrap-based EAF output. Set against disappointing iron ore supply trends from both Australia and Brazil, alongside low supply chain stocks, the market has supported higher prices than earlier expected. The path into 2024 now points to a balanced market versus previous surplus, suggesting no imminent glut risk ahead. Recent feedback from China suggests that

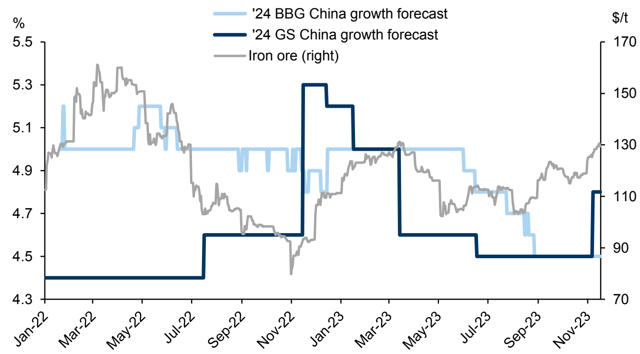
mills are likely to sustain production into Q1 underpinned by building forward demand confidence, and still strong export order books. At a raw material level, we also note that pig iron production remains lower-cost than using scrap, which would continue to support elevated iron ore demand on a relative basis. With onshore mill restocking likely ahead of Chinese New Year and low supply chain inventories, price resilience with greater risk to the upside than downside is now the year-end setting. In this context, we see better price support with our full-year average 62% iron ore forecast for 2023 at $117/t and for 2024 to $110/t, and 3/6M targets of $130/120/t signaling resilient pricing relative to the forward curve pricing.

Exhibit 48: Significant tightening trend seen across current and forward iron ore balance expectations



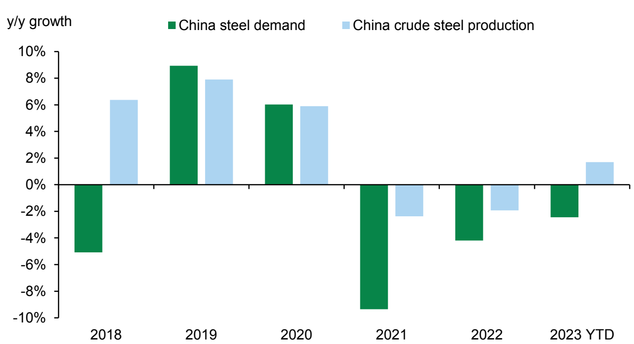
Source: Woodmac, Goldman Sachs Global Investment Research

Exhibit 49: Upgraded China growth expectations for next year provide some support for iron ore price dynamics



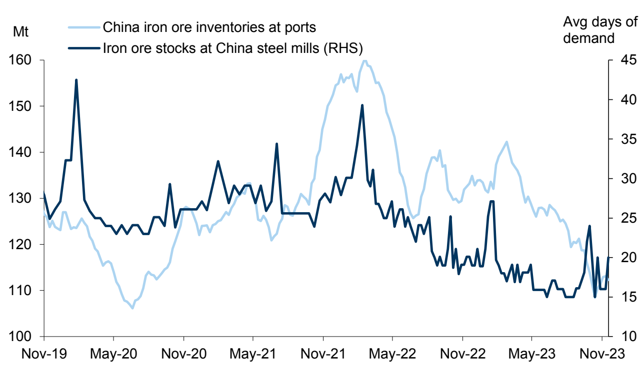
Source: Goldman Sachs Global Investment Research, Bloomberg

Exhibit 50: China's steel production has significantly outperformed demand for the first time since 2018



Source: Wind, Mysteel, Goldman Sachs Global Investment Research

Exhibit 51: Iron ore mill inventories have collapsed to the lowest level since 2016



Source: Wind, Goldman Sachs Global Investment Research

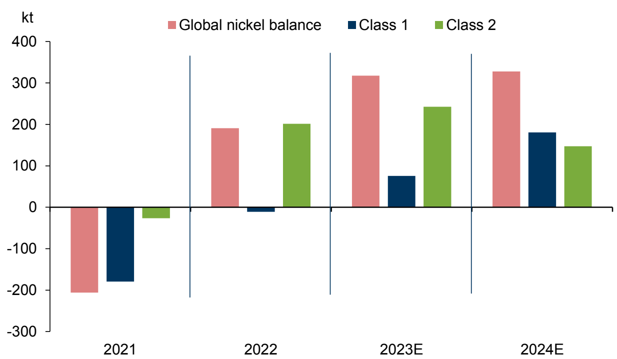
Exhibit 52: GS Global Iron Ore SD Model

(Million tonnes)	2020	2021	2022	1Q23	2Q23E	3Q23E	4Q23E	2023E	2024E	2025E
Crude steel production - DM										
US	73	86	82	19	20	21	21	81	84	88
Japan	83	96	89	22	22	22	23	88	89	89
Western Europe	135	152	136	33	33	30	30	126	129	129
Other DM	19	22	21	5	5	5	5	21	23	23
Sub-DM	**311**	**356**	**328**	**79**	**81**	**77**	**80**	**316**	**324**	**329**
Crude steel production - EM										
China	1054	1029	1010	255	274	259	232	1021	995	985
South Korea	67	71	66	17	17	17	17	68	70	71
India	100	115	124	32	33	35	35	135	149	159
Russia	73	77	71	18	19	19	18	73	73	70
Other EM	245	278	253	57	63	58	61	240	254	275
Asia ex CN/IN/JP/KR	80	78	78	17	18	17	18	70	73	77
Other EM	165	200	175	40	45	41	43	170	181	198
Sub-EM	1539	1570	1524	379	406	388	363	1537	1542	1559
Global crude steel production	**1850**	**1926**	**1852**	**458**	**487**	**466**	**443**	**1853**	**1866**	**1889**
y/y growth	*-1%*	*4%*	*-4%*	*-1%*	*-2%*	*2%*	*2%*	*0%*	*1%*	*1%*
Iron ore demand										
Global iron ore demand 62% Fe	2216	2244	2184	541	576	555	522	2194	2199	2211
y/y growth	*-1%*	*1%*	*-3%*	*-1%*	*-2%*	*3%*	*3%*	*0%*	*0%*	*1%*
China	1404	1346	1335	337	361	346	310	1355	1325	1308
ex-China	812	897	849	204	214	208	212	839	873	903
Seaborne iron ore demand										
Global iron ore seaborne demand 62% Fe	**1597**	**1595**	**1559**	**391**	**416**	**398**	**371**	**1576**	**1580**	**1560**
y/y growth	*1%*	*0%*	*-2%*	*2%*	*-3%*	*3%*	*3%*	*1%*	*0%*	*-1%*
China	1169	1129	1119	287	308	295	265	1156	1153	1124
ex-China	428	466	440	103	108	103	106	420	426	436
Iron ore seaborne supply										
Australia	912	910	916	226	230	233	241	929	950	959
Brazil	331	367	350	69	91	97	97	354	380	393
South Africa	61	60	57	14	14	14	14	56	57	59
Canada	57	58	64	16	15	16	18	65	68	68
Other (India, Mexico, Bosnia, Kazakh, Ukraine etc)	188	174	134	33	33	33	32	131	124	123
Global seaborne supply	**1550**	**1568**	**1519**	**358**	**383**	**393**	**402**	**1536**	**1580**	**1602**
y/y growth	*3%*	*1%*	*-3%*	*4%*	*0%*	*3%*	*-2%*	*1%*	*3%*	*1%*
Global Balance	**-47**	**-27**	**-39**	**-32**	**-33**	**-5**	**31**	**-39**	**0**	**42**
Seaborne price - Iron ore 62% Fe Price										
Current Dollars ($/t)	107	160	118	120	112	113	120	117	110	95

Source: Woodmac, Goldman Sachs Global Investment Research

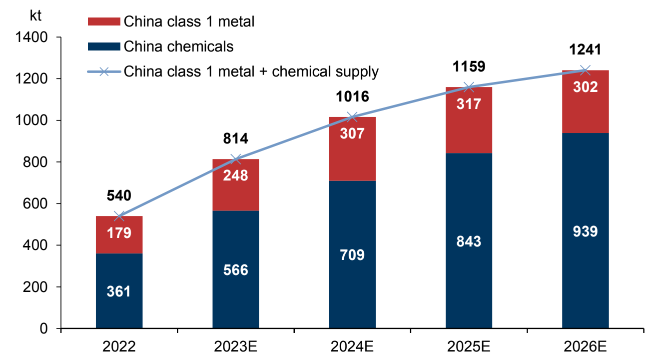
8. Nickel: Surplus pressures building. The nickel market has started to witness pressure from the mounting surplus in the class 1 market, with LME nickel prices falling to a 2-year low. The feedback from the onshore nickel market reaffirmed our expectation that significant class 1 surplus visibility lies ahead with likely continued price pressures. These signals align with our latest supply-demand estimate that places the global nickel market in a 318kt surplus this year, balanced between a 242kt surplus in class 2 nickel and 75kt surplus in class 1 nickel. We expect surplus pressures to mount into 2024 (GSe 328kt surplus), with a significant increase in the class 1 surplus (GSe 180kt surplus) driven by an increase in cathode production in both Indonesia and China. The main additions in class 1 supply are coming from the ramp-up of chemical production through NPI to matte conversion and HPAL (GEM, CNGR, Jinchuan and Huayou Cobalt), alongside new metal capacities in China. We expect Chinese refined assets to add c.250kty of supply in the form of metal and nickel sulphate in 2023-24. In terms of upside risks, Indonesian industrial policy and potential for a future ban on NPI exports or higher export taxes will remain a key area of focus. While supply shocks and macro policy shifts can lead to short-covering, given the magnitude of class 1 surplus that we believe still lies ahead in 2024, we remain bearish on nickel. The history of the nickel market suggests a substantial and sustained price overshoot into the cost curve is likely necessary to materially rebalance the forward balance path. In this context, we lower our 3m LME nickel target to $16,000/t (from $19,000 previously) and our 6/12m targets to $15,000/t (from $17,000/$16,000/t previously).

Exhibit 53: Nickel market to remain in a surplus into 2024 as supply continues to grow



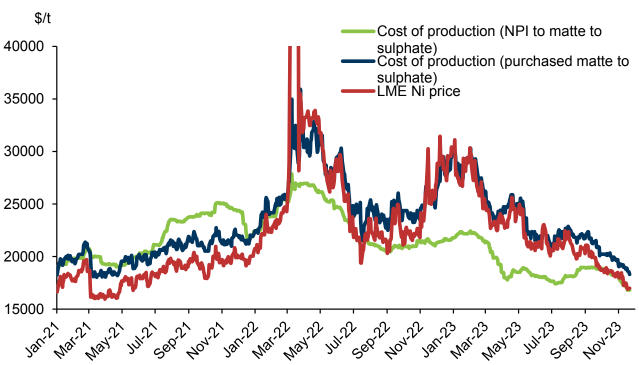
Source: Goldman Sachs Global Investment Research, INSG

Exhibit 54: Chinese refined assets should add c.250kty of metal and nickel sulphate supply each year over 2023-26E



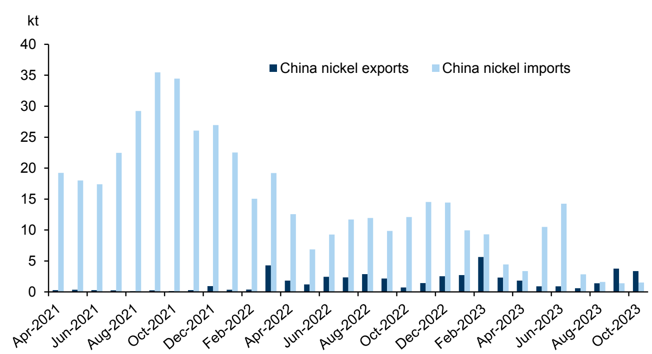
Source: Goldman Sachs Global Investment Research, Woodmac, Bloomberg, Company data

Exhibit 55: Prices have now moved lower than the cost support and margins are coming under pressure



Source: Goldman Sachs Global Investment Research, SMM

Exhibit 56: Chinese refined nickel imports have slowed considerably in H2-23 as onshore refined supply ramps up



Source: Goldman Sachs Global Investment Research, Wind, SMM

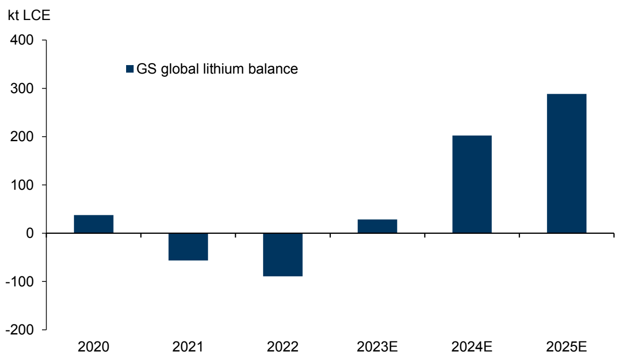
Exhibit 57: GS Global Nickel SD Model

('000 tonnes)	2020	2021	2022	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Consumption - DM											
US	130	138	134	149	169	222	298	348	386	415	456
% change y/y	-13%	6%	-3%	11%	14%	31%	34%	17%	11%	8%	10%
Europe	290	330	313	327	358	395	436	473	517	558	593
% change y/y	-9%	14%	-5%	4%	10%	11%	10%	9%	9%	8%	6%
Japan	131	158	153	158	166	175	180	187	198	209	217
% change y/y	-15%	21%	-3%	4%	5%	6%	2%	4%	6%	6%	3%
Other DM	7	8	9	9	9	9	9	9	9	10	10
% change y/y	-11%	7%	8%	2%	2%	2%	2%	2%	2%	2%	2%
Sub- DM	559	634	608	642	702	802	923	1018	1110	1192	1275
% change y/y	-9%	13%	-4%	6%	9%	14%	15%	10%	9%	7%	7%
Consumption - EM											
China	1447	1522	1598	1763	1944	2116	2156	2239	2275	2362	2451
Indonesia	206	383	370	372	461	521	554	557	560	563	567
China & Indonesia	1653	1906	1968	2135	2405	2637	2710	2796	2835	2925	3018
% change y/y	10%	15%	3%	8%	13%	10%	3%	3%	1%	3%	3%
Other EM	295	337	288	320	340	365	379	401	428	457	485
% change y/y	-18%	14%	-15%	11%	6%	7%	4%	6%	7%	7%	6%
Sub- EM	1949	2243	2256	2456	2745	3001	3089	3197	3264	3382	3503
% change y/y	5%	15%	1%	9%	12%	9%	3%	3%	2%	4%	4%
Global Consumption	**2507**	**2877**	**2864**	**3098**	**3446**	**3804**	**4013**	**4215**	**4373**	**4574**	**4778**
% change y/y	1%	15%	0%	8%	11%	10%	5%	5%	4%	5%	4%
World ex-China & Indonesia	854	971	896	963	1041	1167	1302	1419	1538	1649	1760
% change y/y	-12%	14%	-8%	7%	8%	12%	12%	9%	8%	7%	7%
Global Production											
Global Primary Production	**2546**	**2664**	**3046**	**3397**	**3747**	**4012**	**4274**	**4446**	**4572**	**4567**	**4639**
% change y/y	*7%*	*5%*	*14%*	*12%*	*10%*	*7%*	*7%*	*4%*	*3%*	*0%*	*2%*
China	760	729	848	1047	1208	1330	1457	1524	1613	1613	1686
% change y/y	*-4%*	*-4%*	*16%*	*23%*	*15%*	*10%*	*10%*	*5%*	*6%*	*0%*	*5%*
Indonesia	639	889	1142	1322	1425	1519	1602	1700	1731	1731	1731
% change y/y	*65%*	*39%*	*28%*	*16%*	*8%*	*7%*	*5%*	*6%*	*2%*	*0%*	*0%*
ex-China & Indonesia	1147	1046	1056	1028	1114	1162	1215	1222	1229	1223	1223
% change y/y	*-4%*	*-9%*	*1%*	*-3%*	*8%*	*4%*	*5%*	*1%*	*1%*	*0%*	*0%*
Global Battery Scrap Supply	3	6	8	19	27	42	54	60	75	138	181
Global Balance	**42**	**-206**	**191**	**318**	**328**	**250**	**315**	**291**	**274**	**130**	**43**
Class 1 Nickel balance	-9	-179	-11	75	180	229	253	186	111	-5	-46
Class 2 Nickel balance	52	-27	202	242	147	21	63	106	163	136	90
Cash Prices (annual average)											
Current dollars ($/t)	13803	18474	28316	21684	16000	15500	-	-	-	-	-
Current dollars (c/lb)	626	838	1284	984	726	703	-	-	-	-	-

Source: Goldman Sachs Global Investment Research, Woodmac, SMM, BNEF

9. Lithium: The rationing phase. A rise in supply combined with a shift lower in retail EV volume growth in China (+2.7Mil units in 2022 vs +1.5Mil units in 2023E) has weighed on lithium prices this year. The lithium market is largely balanced in 2023, but we continue to expect a substantial surplus (202kt) over next year. The key softening factor for the balance is the increase in spodumene supply – in particular from Australia and Chinese-owned African assets – adding c.200kt LCE, 55% of total supply growth). This spodumene supply growth, combined with a ramp-up of Chinese lepidolite and brine assets, should add on average 408kty of supply vs a demand growth of 300kty over 2024-25 each year. While lithium prices have corrected sharply, the critical question at the current juncture relates to whether supply adjustments generated by the current price level are enough to limit oversupply. It is true that the elevated cost of production for non-integrated lithium carbonate puts c.80kty capacity currently in a loss-making position. However, we expect the non-integrated cost of production using purchased spodumene (c.120kty in 2024) to fall on average to $14,000/t LCE on a lagged correction in spodumene prices by mid-next year. Furthermore, the total cost for integrated lepidolite production ($11-$14k/t LCE) is substantially below current price levels. In this context, we continue to expect China lithium carbonate prices to fall to $15,000/t and Asia lithium hydroxide to $16,500/t over the next 12 months. The main risk, in our view, to a low-cycle in lithium pricing comes from delays to Chinese expansions from land quota limitations, which are required for tailing management, or slower spodumene ramp-ups.

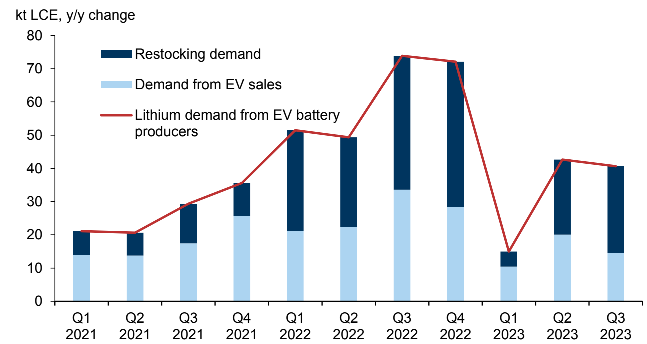
Exhibit 58: Prices are still substantially above the levels required to balance the market



Source: Goldman Sachs Global Investment Research, Woodmac, SMM, Data compiled by Goldman Sachs Global Investment Research

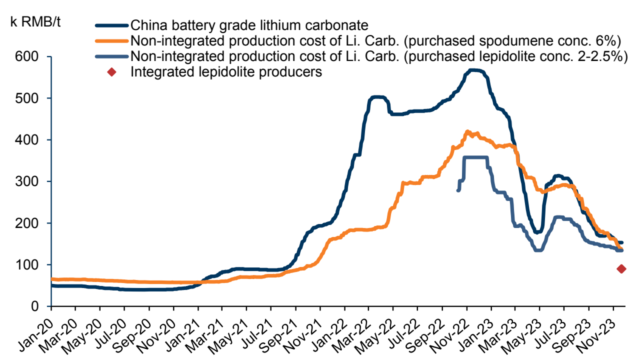
Exhibit 59: Slowing battery metals demand growth reflects moderating incremental EV output volumes in China (+1.5mil units YTD vs +2.5mil units in 2022)

Based on monthly GS lithium demand model



Source: Goldman Sachs Global Investment Research, Wind, SMM

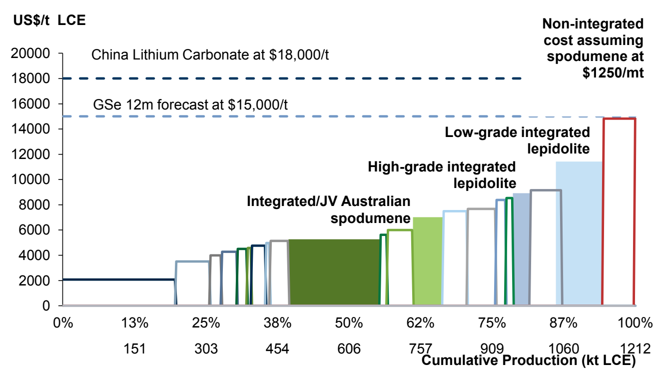
Exhibit 60: Lithium prices remain substantially above the average cost for integrated lepidolite capacity in China



Source: Goldman Sachs Global Investment Research, SMM

Exhibit 61: We expect correction in spodumene prices to lower non-integrated cost of production in the coming quarters

2024 cost curve, excluding royalties and VAT



Source: Goldman Sachs Global Investment Research, Data compiled by Goldman Sachs Global Investment Research, Woodmac

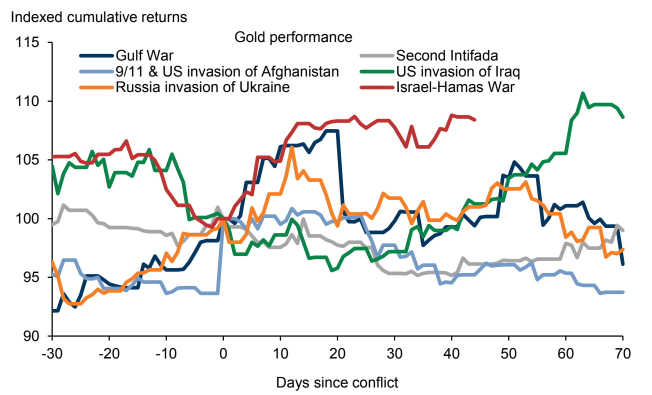
Exhibit 62: GS Global Lithium SD Model

Li ('000 tonnes LCE)	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Global demand											
Consumption - batteries	**191**	**346**	**538**	**766**	**1007**	**1327**	**1622**	**1898**	**2279**	**2654**	**3090**
% change y/y	*35%*	*81%*	*55%*	*43%*	*31%*	*32%*	*22%*	*17%*	*20%*	*16%*	*16%*
EV	103	230	372	547	732	998	1208	1428	1701	1996	2333
ESS	11	18	34	63	91	119	177	196	252	274	332
E-buses, two-wheeler EVs	20	33	48	64	84	102	120	146	187	235	263
Portable electronics	39	41	46	47	48	50	53	56	60	63	67
Other	18	24	37	46	51	57	64	73	79	87	95
Consumption - ex batteries	**130**	**137**	**141**	**144**	**148**	**151**	**155**	**158**	**162**	**165**	**169**
% change y/y	*-2%*	*5%*	*3%*	*2%*	*3%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*
Ceramics	32	34	35	36	37	38	39	40	41	42	43
Glass-ceramics	27	28	29	30	31	31	32	33	34	35	36
Other	71	74	77	78	80	82	83	85	86	88	90
% of global demand		18%	22%	7%	2%	6%	6%	5%	4%	3%	2%
Global demand (excl. restocking)	**321**	**482**	**679**	**910**	**1155**	**1478**	**1777**	**2057**	**2441**	**2820**	**3258**
Global demand (incl. restocking)	**341**	**571**	**827**	**971**	**1173**	**1571**	**1878**	**2154**	**2536**	**2917**	**3338**
% change y/y	*20%*	*67%*	*45%*	*17%*	*21%*	*34%*	*20%*	*15%*	*18%*	*15%*	*14%*
Global Refined Supply	**375**	**506**	**752**	**1099**	**1595**	**2149**	**2561**	**2900**	**3142**	**3235**	**3287**
Brine	**172**	**228**	**326**	**438**	**557**	**727**	**852**	**968**	**1082**	**1124**	**1137**
China	36	60	79	114	135	229	271	307	314	320	327
Ex-China	137	168	247	324	422	498	582	661	768	804	810
Spodumene	**189**	**232**	**342**	**521**	**790**	**1083**	**1346**	**1549**	**1649**	**1672**	**1683**
China	10	7	14	30	59	86	116	172	188	205	221
Ex-China	179	226	328	491	731	997	1230	1377	1461	1468	1461
Other (Lepidolite or Clay)	**13**	**45**	**83**	**140**	**248**	**339**	**363**	**382**	**410**	**439**	**467**
China	13	45	83	140	248	339	363	382	409	435	462
Ex-China	0	0	0	0	0	0	0	0	2	3	5
World output	**375**	**506**	**752**	**1099**	**1595**	**2149**	**2561**	**2900**	**3142**	**3235**	**3287**
% change y/y		*35%*	*49%*	*46%*	*45%*	*35%*	*19%*	*13%*	*8%*	*3%*	*2%*
Total China supply	*59*	*112*	*176*	*284*	*442*	*653*	*749*	*861*	*911*	*960*	*1010*
Total ex-China Supply	*316*	*394*	*576*	*815*	*1153*	*1495*	*1812*	*2038*	*2231*	*2275*	*2277*
% China supply as of global	*16%*	*22%*	*23%*	*26%*	*28%*	*30%*	*29%*	*30%*	*29%*	*30%*	*31%*
Total output (adj. for disruption)	**375**	**506**	**722**	**967**	**1324**	**1783**	**2126**	**2407**	**2608**	**2685**	**2728**
% change y/y		*35%*	*43%*	*34%*	*37%*	*35%*	*19%*	*13%*	*8%*	*3%*	*2%*
Battery Scrap Supply	**4**	**9**	**16**	**33**	**51**	**76**	**95**	**98**	**119**	**205**	**312**
% change y/y		*2%*	*2%*	*3%*	*4%*	*4%*	*4%*	*4%*	*5%*	*8%*	*11%*
Global Balance	**38**	**-56**	**-89**	**29**	**202**	**288**	**343**	**350**	**190**	**-27**	**-298**
as % of global supply	10%	-11%	-12%	3%	15%	16%	16%	15%	7%	-1%	-11%

Source: Goldman Sachs Global Investment Research, Company data, BNEF, IEA, Woodmac

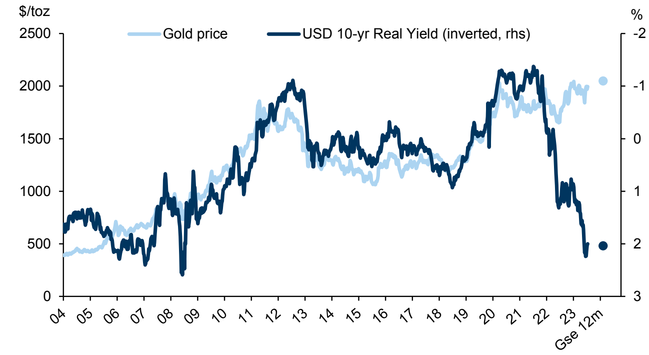
10. Gold: Time to shine. Gold's performance this year has been closely tied to its attractiveness as a tail risk hedge and its relationship with real rates and the dollar. Consistent with gold's historical performance during episodes of high geopolitical tension, prices rose substantially (8%) over the first 25 days since the onset of the Israel-Hamas war, but subsequently fell on fading risk premia and strong US data. The pace at which this geopolitical risk premium was priced pointed to a market that was short entering this episode, and the subsequent fall in prices showed the pressure from elevated rates and a strong dollar. Over the past week, prices have risen again on expectations of a rate cut in the March 2024 FOMC meeting and a weaker dollar following the latest US inflation report, which showed inflation falling faster than expected. Going forward, the rally in gold prices will be closely tied to US real rates and dollar moves, but we also expect strong consumer demand from China and India, alongside central bank buying, to offset downward pressures from upside growth surprises and rate cut repricing. On net, we would expect any sell-off to be limited in scale due to a dovish Fed, slowing inflation, and resilient central bank purchases. Tactically, we would view any sell-off in gold as a buying opportunity as we see an environment with elevated risk channels (geopolitics, recession pricing) ahead playing into gold's hedge qualities. We maintain our 3/6/12m gold target at $2050/toz, albeit with risks skewed to the upside.

Exhibit 63: Gold prices have risen since the start of the Israel-Hamas war...



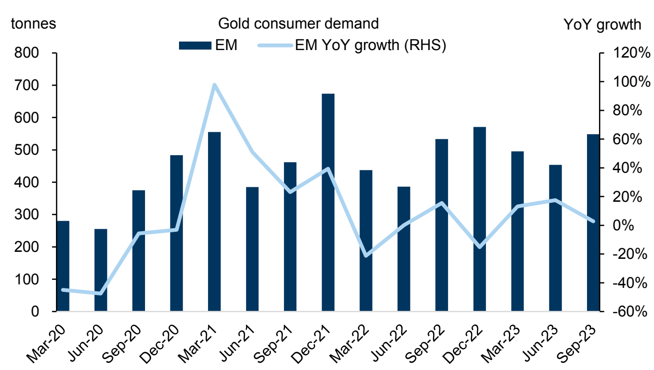
Source: Goldman Sachs Global Investment Research, Bloomberg

Exhibit 64: ... further upside in gold prices will require a significant move lower in real rates and the dollar



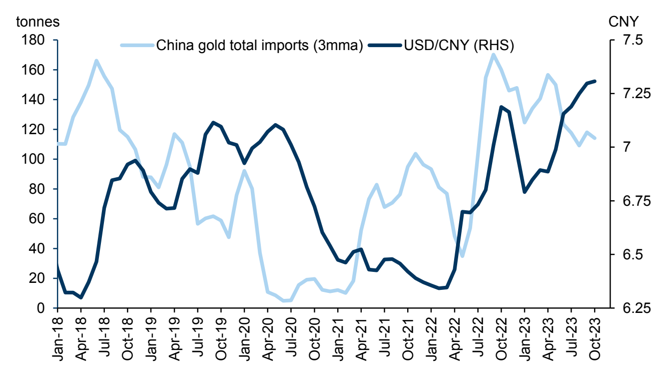
Source: Goldman Sachs Global Investment Research, Bloomberg

Exhibit 65: Strong retail demand has reduced downward pressure on gold prices



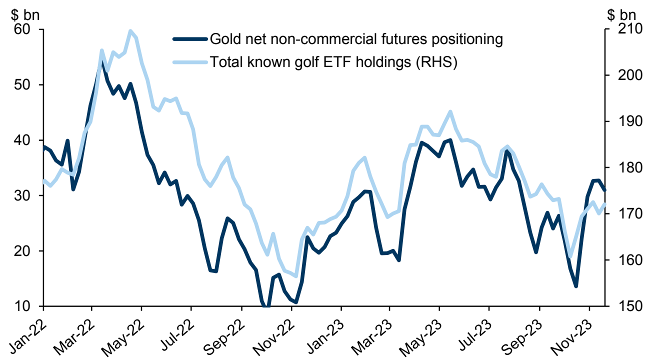
Source: Goldman Sachs Global Investment Research, Metals Focus, World Gold Council

Exhibit 66: CNY depreciation lifted gold demand in China



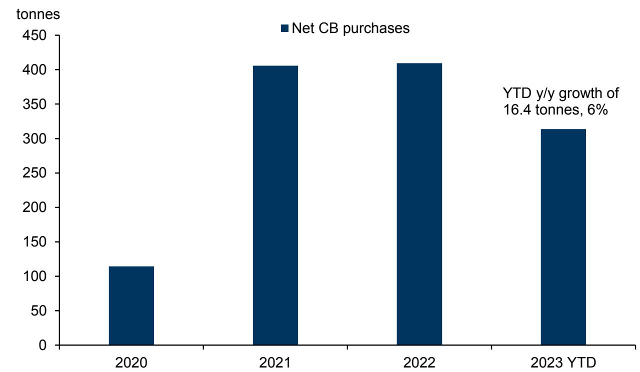
Source: Goldman Sachs Global Investment Research, Bloomberg

Exhibit 67: Short-covering has brought non-commercial net length back to August highs



Source: Goldman Sachs Global Investment Research, Bloomberg

Exhibit 68: Resilient central bank purchases would help limit scale in any sell-off



Source: Goldman Sachs Global Investment Research, Metals Focus, World Gold Council

The authors would like to thank Alissa Gorelova for her contributions to this report. Alissa is an intern within the Commodities team.

Disclosure Appendix

Reg AC

We, Nicholas Snowdon, Aditi Rai and Lavinia Forcellese, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm's business or client relationships.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

Disclosures

Regulatory disclosures

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; for equity securities, market making and/or specialist role. Goldman Sachs trades or may trade as a principal in debt securities (or in related derivatives) of issuers discussed in this report.

The following are additional required disclosures: **Ownership and material conflicts of interest:** Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst's area of coverage. **Analyst compensation:** Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. **Analyst as officer or director:** Goldman Sachs policy generally prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director or advisor of any company in the analyst's area of coverage. **Non-U.S. Analysts:** Non-U.S. analysts may not be associated persons of Goldman Sachs & Co. LLC and therefore may not be subject to FINRA Rule 2241 or FINRA Rule 2242 restrictions on communications with subject company, public appearances and trading securities held by the analysts.

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. **Australia:** Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for "wholesale clients" within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of Global Investment Research of Goldman Sachs Australia may attend site visits and other meetings hosted by the companies and other entities which are the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. To the extent that the contents of this document contains any financial product advice, it is general advice only and has been prepared by Goldman Sachs without taking into account a client's objectives, financial situation or needs. A client should, before acting on any such advice, consider the appropriateness of the advice having regard to the client's own objectives, financial situation and needs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests and a copy of Goldman Sachs' Australian Sell-Side Research Independence Policy Statement are available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Brazil:** Disclosure information in relation to CVM Resolution n. 20 is available at https://www.gs.com/worldwide/brazil/area/gir/index.html. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 20 of CVM Resolution n. 20, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** This information is being provided to you for information purposes only and is not, and under no circumstances should be construed as, an advertisement, offering or solicitation by Goldman Sachs & Co. LLC for purchasers of securities in Canada to trade in any Canadian security. Goldman Sachs & Co. LLC is not registered as a dealer in any jurisdiction in Canada under applicable Canadian securities laws and generally is not permitted to trade in Canadian securities and may be prohibited from selling certain securities and products in certain jurisdictions in Canada. If you wish to trade in any Canadian securities or other products in Canada please contact Goldman Sachs Canada Inc., an affiliate of The Goldman Sachs Group Inc., or another registered Canadian dealer. **Hong Kong:** Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C. **India:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited, Research Analyst - SEBI Registration Number INH000001493, 951-A, Rational House, Appasaheb Marathe Marg, Prabhadevi, Mumbai 400 025, India, Corporate Identity Number U74140MH2006FTC160634, Phone +91 22 6616 9000, Fax +91 22 6616 9001. Goldman Sachs may beneficially own 1% or more of the securities (as such term is defined in clause 2 (h) the Indian Securities Contracts (Regulation) Act, 1956) of the subject company or companies referred to in this research report. Investment in securities market are subject to market risks. Read all the related documents carefully before investing. Registration granted by SEBI and certification from NISM in no way guarantee performance of the intermediary or provide any assurance of returns to investors. Goldman Sachs (India) Securities Private Limited Investor Grievance E-mail: india-client-support@gs.com. Compliance Officer: Anil Rajput |Tel: + 91 22 6616 9000 | Email: anil.m.rajput@gs.com. **Japan:** See below. **Korea:** This research, and any access to it, is intended only for "professional investors" within the meaning of the Financial Services and Capital Markets Act, unless otherwise agreed by Goldman Sachs. Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither "registered banks" nor "deposit takers" (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for "wholesale clients" (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests is available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Russia:** Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. Research reports do not constitute a personalized investment recommendation as defined in Russian laws and regulations, are not addressed to a specific client, and are prepared without analyzing the financial circumstances, investment profiles or risk profiles of clients. Goldman Sachs assumes no responsibility for any investment decisions that may be taken by a client or any other person based on this research report. **Singapore:** Goldman Sachs (Singapore) Pte. (Company Number: 198602165W), which is regulated by the Monetary Authority of Singapore, accepts legal responsibility for this research, and should be contacted with respect to any matters arising from, or in connection with, this research. **Taiwan:** This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. **United Kingdom:** Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.

European Union and United Kingdom: Disclosure information in relation to Article 6 (2) of the European Commission Delegated Regulation (EU) (2016/958) supplementing Regulation (EU) No 596/2014 of the European Parliament and of the Council (including as that Delegated Regulation is implemented into United Kingdom domestic law and regulation following the United Kingdom's departure from the European Union and the European Economic Area) with regard to regulatory technical standards for the technical arrangements for objective presentation of investment recommendations or other information recommending or suggesting an investment strategy and for disclosure of particular interests or indications of conflicts of interest is available at https://www.gs.com/disclosures/europeanpolicy.html which states the European Policy for Managing Conflicts of Interest in Connection with Investment Research.

Japan: Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan Type II Financial Instruments Firms Association, The Investment Trusts Association, Japan, and Japan Investment Advisers Association. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Global product; distributing entities

Goldman Sachs Global Investment Research produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; Public Communication Channel Goldman Sachs Brazil: 0800 727 5764 and / or contatogoldmanbrasil@gs.com. Available Weekdays (except holidays), from 9am to 6pm. Canal de Comunicação com o Público Goldman Sachs Brasil: 0800 727 5764 e/ou contatogoldmanbrasil@gs.com. Horário de funcionamento: segunda-feira à sexta-feira (exceto feriados), das 9h às 18h; in Canada by Goldman Sachs & Co. LLC; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman Sachs & Co. LLC. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom.

Goldman Sachs International ("GSI"), authorised by the Prudential Regulation Authority ("PRA") and regulated by the Financial Conduct Authority ("FCA") and the PRA, has approved this research in connection with its distribution in the United Kingdom.

European Economic Area: GSI, authorised by the PRA and regulated by the FCA and the PRA, disseminates research in the following jurisdictions within the European Economic Area: the Grand Duchy of Luxembourg, Italy, the Kingdom of Belgium, the Kingdom of Denmark, the Kingdom of Norway, the Republic of Finland and the Republic of Ireland; GSI - Succursale de Paris (Paris branch) which is authorised by the French Autorité de contrôle prudentiel et de resolution ("ACPR") and regulated by the Autorité de contrôle prudentiel et de resolution and the Autorité des marches financiers ("AMF") disseminates research in France; GSI - Sucursal en España (Madrid branch) authorized in Spain by the Comisión Nacional del Mercado de Valores disseminates research in the Kingdom of Spain; GSI - Sweden Bankfilial (Stockholm branch) is authorized by the SFSA as a "third country branch" in accordance with Chapter 4, Section 4 of the Swedish Securities and Market Act (Sw. lag (2007:528) om värdepappersmarknaden) disseminates research in the Kingdom of Sweden; Goldman Sachs Bank Europe SE ("GSBE") is a credit institution incorporated in Germany and, within the Single Supervisory Mechanism, subject to direct prudential supervision by the European Central Bank and in other respects supervised by German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin) and Deutsche Bundesbank and disseminates research in the Federal Republic of Germany and those jurisdictions within the European Economic Area where GSI is not authorised to disseminate research and additionally, GSBE, Copenhagen Branch filial af GSBE, Tyskland, supervised by the Danish Financial Authority disseminates research in the Kingdom of Denmark; GSBE - Sucursal en España (Madrid branch) subject (to a limited extent) to local supervision by the Bank of Spain disseminates research in the Kingdom of Spain; GSBE - Succursale Italia (Milan branch) to the relevant applicable extent, subject to local supervision by the Bank of Italy (Banca d'Italia) and the Italian Companies and Exchange Commission (Commissione Nazionale per le Società e la Borsa "Consob") disseminates research in Italy; GSBE - Succursale de Paris (Paris branch), supervised by the AMF and by the ACPR disseminates research in France; and GSBE - Sweden Bankfilial (Stockholm branch), to a limited extent, subject to local supervision by the Swedish Financial Supervisory Authority (Finansinpektionen) disseminates research in the Kingdom of Sweden.

General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. The information, opinions, estimates and forecasts contained herein are as of the date hereof and are subject to change without prior notification. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by Global Investment Research. Goldman Sachs & Co. LLC, the United States broker dealer, is a member of SIPC (https://www.sipc.org).

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and principal trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, principal trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

We and our affiliates, officers, directors, and employees will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives, if any, referred to in this research, unless otherwise prohibited by regulation or Goldman Sachs policy.

The views attributed to third party presenters at Goldman Sachs arranged conferences, including individuals from other parts of Goldman Sachs, do not necessarily reflect those of Global Investment Research and are not an official view of Goldman Sachs.

Any third party referenced herein, including any salespeople, traders and other professionals or members of their household, may have positions in the products mentioned that are inconsistent with the views expressed by analysts named in this report.

This research is focused on investment themes across markets, industries and sectors. It does not attempt to distinguish between the prospects or performance of, or provide analysis of, individual companies within any industry or sector we describe.

Any trading recommendation in this research relating to an equity or credit security or securities within an industry or sector is reflective of the investment theme being discussed and is not a recommendation of any such security in isolation.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors. Investors should review current options and futures disclosure documents which are available from Goldman Sachs sales representatives or at https://www.theocc.com/about/publications/character-risks.jsp and https://www.fiadocumentation.org/fia/regulatory-disclosures_1/fia-uniform-futures-and-options-on-futures-risk-disclosures-booklet-pdf-version-2018. Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

Differing Levels of Service provided by Global Investment Research: The level and types of services provided to you by Goldman Sachs Global Investment Research may vary as compared to that provided to internal and other external clients of GS, depending on various factors including your individual preferences as to the frequency and manner of receiving communication, your risk profile and investment focus and perspective (e.g., marketwide, sector specific, long term, short term), the size and scope of your overall client relationship with GS, and legal and regulatory constraints. As an example, certain clients may request to receive notifications when research on specific securities is published, and certain clients may request that specific data underlying analysts' fundamental analysis available on our internal client websites be delivered to them electronically through data feeds or otherwise. No change to an analyst's fundamental research views (e.g., ratings, price targets, or material changes to earnings estimates for equity securities), will be communicated to any client prior to inclusion of such information in a research report broadly disseminated through electronic publication to our internal client websites or through other means, as necessary, to all clients who are entitled to receive such reports.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research, models or other data related to one or more securities, markets or asset classes (including related services) that may be available to you, please contact your GS representative or go to https://research.gs.com.

Disclosure information is also available at https://www.gs.com/research/hedge.html or from Research Compliance, 200 West Street, New York, NY 10282.