

Oil

Squaring Russia's missing barrels

- Oil prices have surged to their highest level since 2008, driven by the escalating military conflict in Ukraine and growing realization that imposed sanctions could meaningfully and sustainably reduce Russian exports, even with carve-outs for energy trade. Given Russia's key role in global energy supply, the global economy could soon be faced with one of the largest energy supply shocks ever.
- The West will want to avoid such an outcome, but global isolation could instead drive Russia to reduce its current account surplus and energy exports. We believe China will hold a crucial role in shaping how the oil market will rebalance, and how much Russian oil exports end up shrinking, with logistical constraints likely to prevent a full reallocation of flows for months. We expect supply to respond but this will be a politically driven process, between SPR releases, a core-OPEC surge and potential lift of sanctions on oil imports from Iran and Venezuela. While all of these measures could help offset a sizable decline in Russian seaborne exports, they would leave the global oil market with no buffer, still requiring demand destruction through higher prices. The shale supply response would further remain modest initially, due to drilling times, still cautious producers and a tight service sector.
- The uncertainty on how this conflict and oil shortages will be resolved is unprecedented. To attempt to provide an estimate of where oil prices are heading, we build three scenarios, ranging from a resumption in exports in the coming months to a sustained two-thirds reduction of Russian seaborne exports. Even assuming SPR and OPEC supply relief, these point to oil prices ranging from \$115/bbl to \$175/bbl in 2022. Given a still intensifying military conflict, escalating Western sanctions and growing isolation of Russia, our subjective probability weighting of these potential outcomes currently leaves us base-casing a 1.6 mb/d disruption. As a result, we are raising our 2022 Brent spot price forecast to \$135/bbl, with our 2023 forecast at \$115/bbl, up from \$98 and \$105/bbl respectively.
- The range of possible outcomes remains extreme given the threat that a spike in oil prices represents to the global economy. We reiterate our view, however, that long-dated oil prices remain significantly under-priced, still below our pre-Ukraine escalation forecast.

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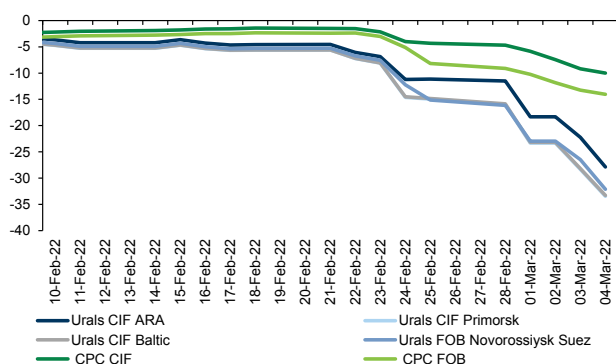
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A potentially enormous oil supply shock

- Ten days on, sanctions - imposed or feared - continue to severely disrupt Russian seaborne oil exports. This is despite greater clarity that financial energy transactions could continue, with the reiterated exemption of SWIFT exclusion for certain Russian banks and for energy transactions. In our view, this reflects the threat of additional sanctions, for example a potential US ban on Russian oil imports, or of public censure. Case in point, the sole purchase of a cargo of Russian oil on Friday, March 4 was immediately followed by public reprobation and will likely strongly disincentivize further Western acquisition.
- While loading data remains volatile, reports point to more than half of March loadings remaining unsold, consistent with the exceptional discount of Russian export barrels relative to Brent. If sustained, this would represent a 3 mb/d decline in Russian crude and petroleum product seaborne exports, the fifth largest one-month disruption since WWII, after the Arab Oil Embargo (1973), the Iranian Revolution (1978), the Iran-Iraq war (1980), and the Iraq-Kuwait war (1990). This disruption could further start impacting Kazakhstan piped barrels, which are typically commingled with Russian crude on the CPC pipeline. While the current sanctions have not been directly imposed on Russia's oil sector, the intensification of the military conflict and the broader sanctions on Russia's Central Bank are instead poised to significantly and sustainably reduce Russia's own incentive to export energy.

Exhibit 1: Most Russian crudes are trading at severe discounts given the lack of willing buyers

Russia crude grades price assessments vs. Dated Brent strip (USD/bbl)



Source: Platts, Goldman Sachs Global Investment Research

Exhibit 2: Sanctions on Russian crude could create one of the largest - and most enduring - disruptions that the oil market has ever seen

Largest post-war oil supply disruptions (mb/d)

Event	Year	Peak supply loss (mb/d)
Abqaiq attacks	2019	5.7
Iranian revolution	1978	5.6
Arab oil embargo	1973	4.3
Iraq-Kuwait war	1990	4.3
Iran-Iraq war	1980	4.1
Venezuela oil strike	2002	2.3
Iraq war	2003	2.3
Iraq oil export suspension	2001	2.2
Suez crisis	1956	2.0
Six-Day War	1967	2.0
Libya Civil War	2011	1.6
Texas Winter Storm	2021	1.5

Source: Bloomberg, IEA, Goldman Sachs Global Investment Research

- With its foreign assets frozen, the Russian Central Bank is closing its capital account, implying a potential drop in commodity exports to match imports (or turn into a dollar-denominated economy). Even if Russian oil and gas companies act as custodians for the FX surplus generated by energy exports, current sanctions would prevent transfer of these surpluses to the Central Bank or Treasury to make sovereign debt payments or pay other receipts. In addition, there would remain the threat of potential future Western seizure of these accumulated corporate foreign FX

reserves. As a result, while a balanced capital account would still allow for exports, trade would progressively be forced to match imports on a nominal \$ basis.

- Importantly, each move lower in commodity exports, and hence global supply, would then raise the unit value of the remaining exports, forcing a further reduction in barrels to keep the nominal value of exports constant. In effect, a closed capital account creates a backward bending supply curve for Russian commodity exports - less supply raises prices, which incentivizes even less supply. The key additional risk for Russian oil exports would come from any potential default from its private oil and gas exporters (or nationalization followed by sovereign default) as potential export seizures would further reduce the incentive to export.
- Storage capacity and geology would admittedly slow the contraction in Russian exports. We estimate Russian oil available spare storage capacity at 80 mb, filled within a month in a severe disruption scenario (with floating storage in turn contracting the global availability of vessels). At the field level, while Russia was able to cut production by 2 mb/d in May 2020, such a process has had clear scarring effects for its low pressure conventional producing reservoirs.

Net, we believe that the sanctions on Russia could be setting in motion a potentially large fall in global oil supply that would redraw the global energy map. In the short-term, coping with such a supply shock would require the combined help of global strategic reserves, core-OPEC, Iran, and higher prices to reduce consumption. In coming years, it would lead to a sharply faster rise in shale production and more persistent erosion in demand growth through prices staying at historically elevated levels. Finally, in the medium-term, such a shock is likely to accelerate the drive towards locally sourced electricity (nuclear, renewables, storage). Estimating a potential trading range for oil prices requires mapping the possible pathways to balancing the oil market in the coming months, through China, OPEC supply, SPR and finally, and likely most binding, demand destruction.

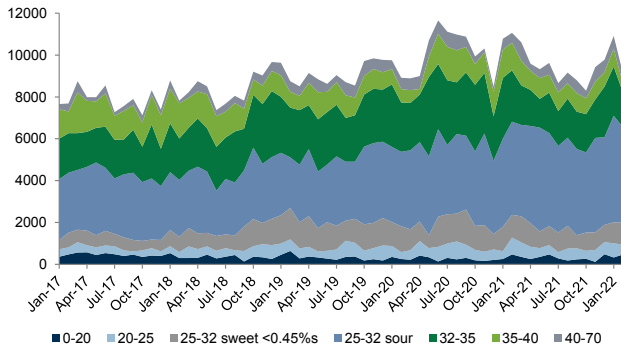
China key to determining how the oil market will rebalance

As a potential sizable buyer of Russian crude, China will hold a critical role in how the oil market rebalancing plays out. While China likely has the logistical ability to take on higher Russian exports, key to the potential price upside will be its willingness to rapidly become Russia's predominant trade partner.

- Logistically, China imports 1.5 mb/d of Russia's 6 mb/d seaborne exports and could feasibly take the majority of the EU-US combined 4 mb/d imports. First, from a crude import quality perspective, Russia's crude is well suited to displace up to 3 mb/d of similar quality medium sour crude imports from outside of Russia. Second, imports can increase from their recent 10 mb/d level, with a peak import capacity above 12.7 mb/d, and with the country able to replenish its depleted inventories, down at least 100 mb since their Nov-20 peak. This would admittedly not be a smooth process, as a full redirection of oil flows to the East would still tighten global markets, as it would require a 12-day increase in transit time, equivalent to the loss of 90 million barrels (nearly double Iran's current floating storage).

Exhibit 3: China imports crudes similar to Russia’s main export grades, allowing for substitution

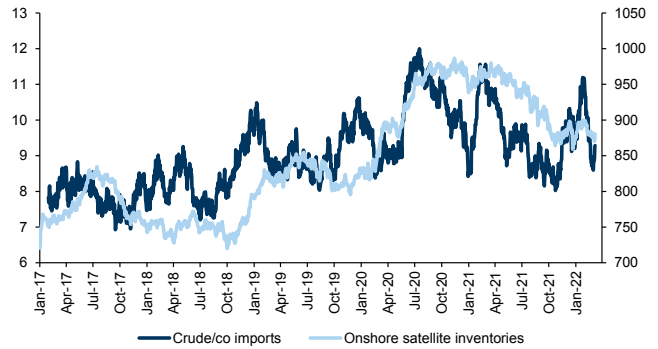
China crude/condensate seaborne imports by grade (degrees API, kb/d)



Source: Kpler, Goldman Sachs Global Investment Research

Exhibit 4: China also has significant room to ramp up imports and rebuild storage at attractive price discounts

China seaborne crude/condensate imports (lhs, mb/d) vs onshore satellite crude inventories (rhs, mb)

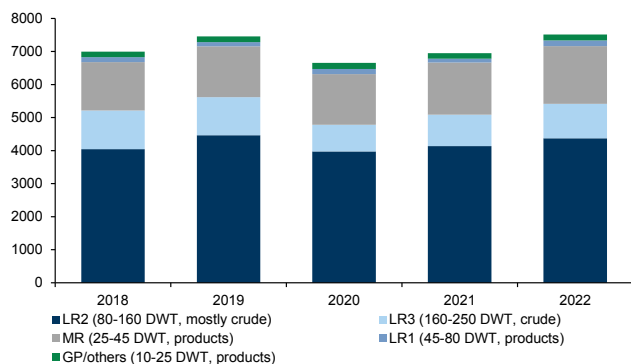


Source: Kpler, Goldman Sachs Global Investment Research

- The potential key bottleneck that could arise in such a redirection is the availability of additional ships necessary to operate on this longer route, alongside a similarly inefficient reallocation of displaced Chinese import flows. This pull on the global fleet could be exacerbated by the potential for additional sanctions on Russian-flagged vessels as well as due to draft restrictions on Russian Black Sea ports. In particular, none of Russia’s exports flow via VLCCs or ULCCs, typically using LR2s (c.500kb-1mb) for its crude, and predominantly MR vessels (c.150kb-300kb) for its products. On our calculations, however, Russia’s trade requires less than 10% of the global LR and MR fleet, with China’s LR and MR fleet alone twice the size of that needed to sustain the entirety of Russia’s oil flows. Overall, global shipping capacity should not be a limiting factor for reallocating Russian oil flows, although it may come at the expense of elevated freight rates and fast-steaming of tankers to increase effective capacity.

Exhibit 5: Russia exports most of its oil on smaller ships, with draft restrictions at most of its ports preventing VLCCs

Russia seaborne crude exports by vessel type (kb/d)



Source: Kpler, Goldman Sachs Global Investment Research

Exhibit 6: A redirection of Russian exports from the West to Asia would still tighten the global market given longer trade routes

Russia oil (crude and product) exports by location, and under hypothetical scenarios (mb/d)

	Travel time	Nov-Jan flows	Scenarios	
			Full redirection	Incomplete redirection
Western Europe	7	1.71	0.00	0.00
Eastern Asia	35	1.53	3.50	3.00
Southern Europe	12	1.23	0.00	0.00
Northern Europe	4	0.78	0.00	0.00
Eastern Europe	2	0.90	0.50	0.50
Northern America	18	0.41	0.00	0.00
South-East Asia	27	0.20	1.00	0.50
Middle East	20	0.13	0.80	0.50
South-Central Asia	22	0.14	0.80	0.50
Others	17	0.25	0.68	0.63
Total (mb/d)		7.28	7.28	5.63
Weighted average sailing time	14.9		27.0	27.0
Increase in transit storage (mb)			88	44
Effective increase in VLCC equivalents			44	22

Source: Kpler, Goldman Sachs Global Investment Research

- The hurdle to such a full redirection of crude flows is ultimately political rather than physical, in our view. While oil trades are exempt from current economic sanctions,

the use and handling of Russia's CNY proceeds and the associated FX reserves could (initially) leave China reluctant to increase imports at a time when Russia is becoming a global pariah. Illustrating this point, there are no reports of increased Chinese purchases of Russian crude so far, with China similarly not scaling up imports of Iranian or Venezuelan crude in recent years. Conversely, the potential outcome where China guarantees Russia full use of its banking system, protecting CNY reserves, could lead Russia to try to maximize its crude exports. Such a large redirection of seaborne crude would, however, likely face the friction of China having to displace other crude imports - most likely from the Middle East - given their termed nature and core-OPEC's expectation of falling DM oil consumption in coming years.

Ultimately, the incentives to see such a redirection are high: for the West, as it would help achieve the clearly stated goal of not disrupting global energy supplies; for Russia, as it would lessen the impact of sanctions and reinforce its "no limits partnership" with China; for China, as it could extend its sphere of economic influence as well as guarantee a significant supply of discounted crude. On net, we expect that China is likely to ramp-up Russian crude imports, although a full redirection appears less likely initially given logistical hurdles and Russia's own disincentive to accumulate large foreign FX reserves.

Supply relief would come at a higher price and require core-OPEC, Iran and Venezuela

With China potentially unable to absorb all Russian exports, the call for incremental supply will have to draw upon three sources: core-OPEC at up to c. 1.5 mb/d over a few months, with Iran and Venezuela potentially adding up to another 1.5 mb/d over a year. Government SPR releases could help in the short-term, with the ability to likely flow at least at 2 mb/d for a few months. The shale response would likely then follow, with up to 1 mb/d of additional supply growth over a year. Importantly, most of these supply responses are politically driven, would likely require higher prices, not be immediate, and leave the world devoid of spare capacity.

- We estimate that Saudi Arabia, the UAE and Kuwait could potentially ramp up production by 2.1 mb/d from current levels within a couple months. Their near-term productive capacity is likely lower than in April 2020 since drilling activity has been half of its 1Q20 level over the past year. With OPEC silent so far, such a response would likely require a sustained fall in Russian exports and higher prices that would presage potentially much weaker economic growth and lower long-term fiscal revenues. The unanimous nature of OPEC decisions creates two additional hurdles, reinforcing its price dependency: a surge would likely only be considered after deals with Iran and Venezuela are concluded, and would likely imply an end to the OPEC+ agreement with Russia. While such an outcome becomes increasingly likely the more Russia is excluded from the global economy, driving core-OPEC, Iran and the West closer together to increase supply, it would nonetheless likely take weeks to reach and a month for supply to start increasing.
- A deal to return to the JCPOA agreement with Iran could help bring additional

barrels to the global market, which we now conservatively base-case. Despite headlines that Russia could derail a P5+1 agreement, the issuance of export waivers remains a unilateral US decision. We reiterate our view, however, that the associated ramp-up in Iran oil flows would neither be large nor immediate, with implementation and certification leaving for a 3Q22 ramp-up in exports, even if a deal were to be signed now. The discharge of Iran’s 40 mb floating condensate would further take time given the limited number of potential buyers, with the 20 mb crude floating storage discharge also likely slowed by necessary vessel inspections and competition from discounted Russian barrels. Most importantly, the return of Iran’s production may have already been nullified by the tightness in the global oil market before the escalation in Ukraine, with the global oil deficit in February turning out to be 0.7 mb/d larger than our above-consensus forecast (with Iraq and Libya now experiencing outages). We see potential for additional sanctions relief, for example the easing of oil sanctions on Venezuela, which could increase supply by up to 0.5 mb/d from current depressed levels over the next six months, and eventually another 0.5 mb/d in coming years (due to large underlying decline rates).

Exhibit 7: The only remaining reliable spare capacity is in core-OPEC countries and even this would take several months to ramp-up

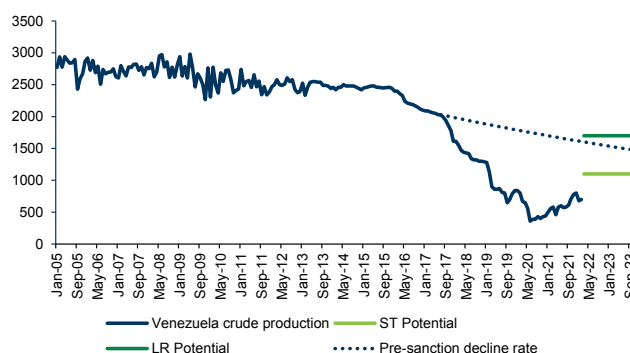
Core-OPEC crude production and 6-month capacity (mb/d)

	Feb-22	Capacity	Spare capacity
Saudi Arabia	10.20	11.50	1.30
UAE	2.95	4.10	1.15
Kuwait	2.61	2.86	0.25
Total	15.76	18.46	2.70

Source: Platts, Reuters, OPEC, Goldman Sachs Global Investment Research

Exhibit 8: Upside to Venezuelan production remains limited by underlying declines and underinvestment

Venezuela crude production (kb/d)

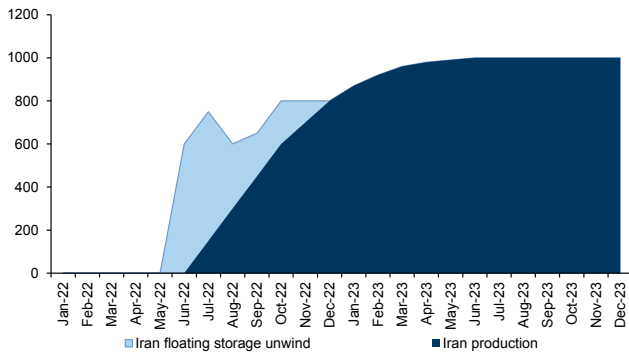


Source: IEA, Goldman Sachs Global Investment Research

- The lag in OPEC’s relief could be partially compensated by an accelerated large release of global government strategic reserves. The logistical discharge rate of SPRs, although massive at 4 mb/d per the IEA, remains untested. For example, the cumulative observed peak one-month draw rate of 2.7 mb/d would likely suffice for most shortfalls in Russian exports. A possible limitation could arise in the US if the reshuffling of the US pipeline network to accommodate shale production creates congestion for the SPR discharge.

Exhibit 9: Iranian production would increase in 3Q22 at the earliest in our view, with floating storage perhaps starting to draw down ahead of time

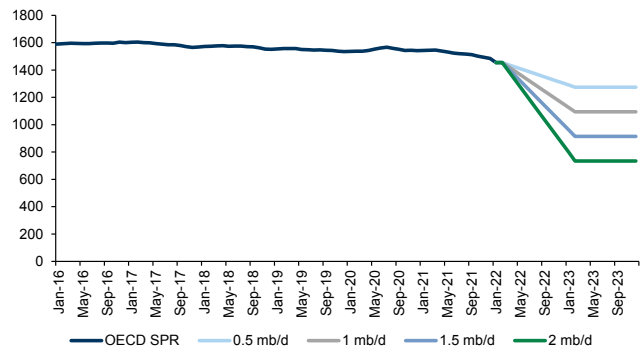
Increase in Iran crude and condensate production/exports assuming an imminent deal (kb/d)



Source: Goldman Sachs Global Investment Research

Exhibit 10: OECD emergency stockpiles could easily handle a 1 mb/d drawdown over a year without significantly depleting oil stocks

IEA OECD government stocks (mb) and assuming various 12 month drawdowns



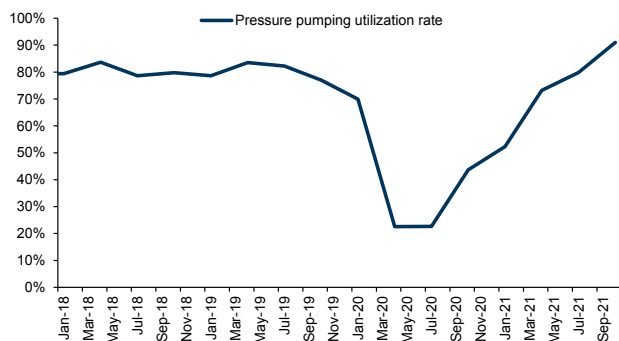
IEA emergency stocks are sometimes held within commercial inventories meaning the above figures are likely an underestimate

Source: IEA, Goldman Sachs Global Investment Research

- Finally, the price induced shale supply response would not be a suitable rebalancing mechanism for a large and immediate supply shock, given the lag in capex raises and the several months needed to drill and bring new wells online. The largest constraint to a fast ramp-up in shale production is likely to come from an already tight oil service sector. For example, our US equity energy analysts estimate via our shale macro corporate model that it would take sustained Brent prices of \$140/bbl to increase shale production growth to reach 1.3 mb/d over the coming year (0.5 mb/d on average higher than our 0.8 mb/d base-case, ie. corresponding to an incremental 1 mb/d exit-to-exit), assuming producers' cash flow reinvestment rate of 30% and service cost inflation reaches 30% yoy. Importantly, this would require a 100% utilization level of available US frac crews, a tall order that would likely reinforce cost inflation pressures. In fact, our US energy service analysts estimate that another 1 mb/d of 2023 shale production growth (outright) would then require a 35% increase in active fleets, which would increase E&P spending by a total of at least 45% (y/y 2023) including incremental cost inflation from high activity and the need to incentivize newbuild frac fleets. In addition, any higher production increase would in turn require additional midstream pipeline capacity, a lengthy process even if the current US regulatory hurdles are eased.

Exhibit 11: Pressure pumping utilization rates are already back to previous highs, limiting the ability to aggressively ramp-up shale production

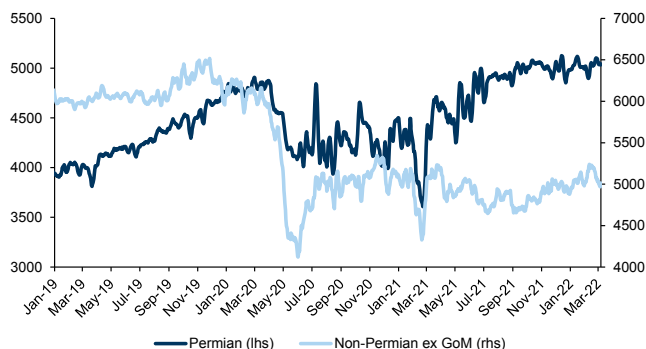
Total Frac HHP demand vs. supply



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 12: Higher shale activity would require record Permian crude production and growth in legacy basins, a large pull on services

US onshore crude oil production (kb/d)



Source: Genscape, Goldman Sachs Global Investment Research

Demand destruction the solver of last resort

Barring a breakthrough in peace negotiations, a potential large fall in Russian exports would ultimately require oil prices to rally sharply to also reduce consumption. This first reflects that demand elasticity is the only *immediate large* balancing mechanism with global inventories already at record lows and given the lag of several months in deploying meaningful supply responses. Second, such a demand led rebalancing would still be required alongside a surge in OPEC production as the oil market would then be devoid of spare capacity, with lower demand necessary to help build precautionary inventories as a buffer to any additional issue. This is consistent with our recent work showing that long-term shortages require near-term surpluses in commodity markets, with additional supply risks potentially arising from the surge in wheat prices, as occurred during the Arab Spring. Further, mapping this demand elasticity is key to helping quantify the potential upside to oil prices, given the geopolitical nature of the OPEC and SPR supply responses.

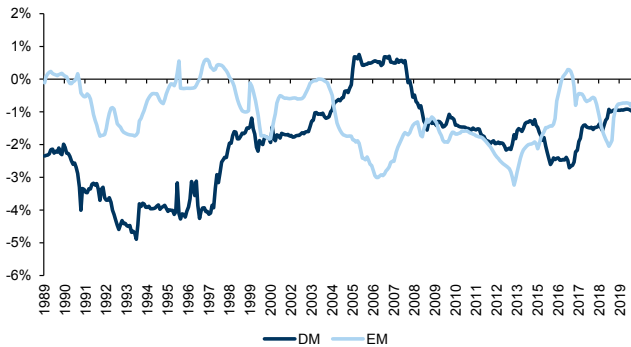
Looking at observed demand elasticities in past decades points to a potential 1 mb/d demand hit should prices rally from \$115 to \$150/bbl. The much larger oil shocks of the 1970s show, however, that the large share of taxes in retail prices and potential for price intervention could diminish such a demand response and raise the equilibrium crude oil price.

- While such a large potential supply shock has not occurred since 1990, monthly data availability across countries since 2000 is nonetheless useful in estimating how global demand could respond. Our recent work points to demand elasticities of 2% and 2.5% for DM and EM respectively. For DMs, we found that elasticities had decreased since the 1990s, when oil was a larger part of the consumption baskets and more oil competed in the power sector, but have increased modestly since the 2000s due to higher taxation. The US elasticities have declined most given the combined effects of stable nominal taxes, a faster ramp-up in vehicle efficiency (from low levels) and rising wealth. In EMs, elasticities have instead increased in

recent years due to price liberalization, rapidly growing demand per capita and weakening currencies. We note, however, that demand elasticities increase as oil prices rise, as witnessed in the 2000s, and as a result, use an aggregate 3% demand elasticity.

Exhibit 13: Demand elasticities have declined in DM but edged higher in EM due to price liberalizations

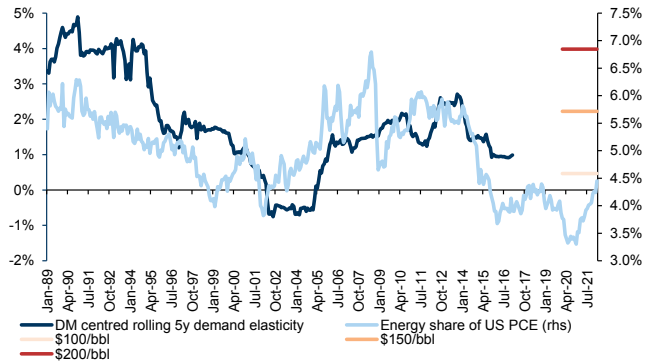
Demand price elasticities from rolling regressions of DM/EM demand on GDP and prices (Average of 5, 10-yr windows, for lags of 1/3m and 3/6m for DM and EM respectively)



Source: IEA, ICE, Haver Analytics, Goldman Sachs Global Investment Research

Exhibit 14: Higher oil prices tend to result in higher demand elasticities due to larger income effects

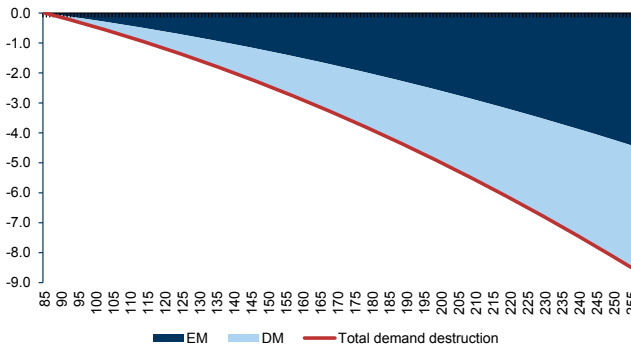
Energy share of US PCE (rhs) with projections for different Brent crude prices vs re-centered rolling DM demand elasticity (lhs)



Source: IEA, EIA, Haver Analytics, Goldman Sachs Global Investment Research

Exhibit 15: Prices around \$200/bbl would likely be enough to offset a cut-off of Russian oil exports outside of current China volumes

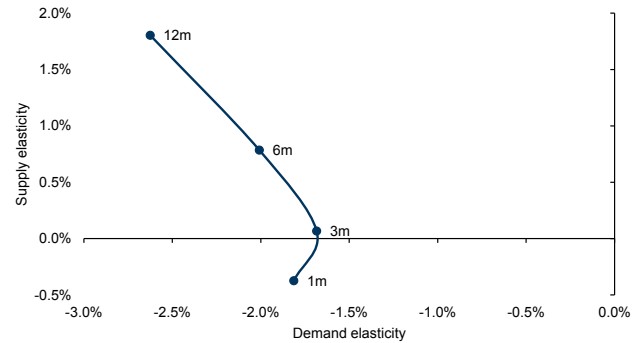
Demand destruction (y-axis, mb/d) at different Brent price levels (x-axis, USD/bbl) from our pre-January \$85/bbl base



Source: Goldman Sachs Global Investment Research

Exhibit 16: Demand elasticity is the short-term balancing mechanism of last resort while (non-OPEC) supply is too slow to respond

Estimated elasticities over different time horizons of demand (DM) and supply (non-OPEC) since 2015

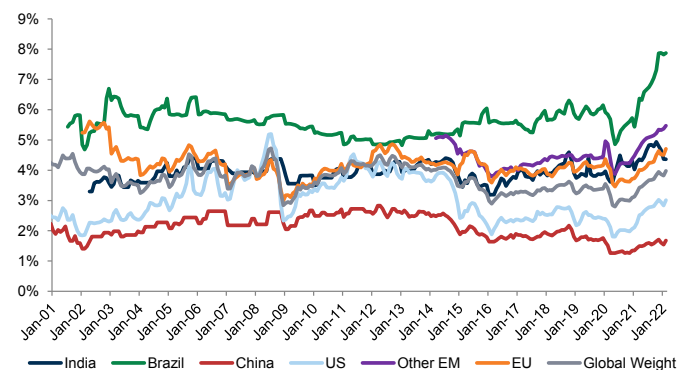


Source: IEA, Goldman Sachs Global Investment Research

- This demand adjustment will vary significantly across countries, a function of their current consumption basket, potential price controls and exchange rate flexibility. Simplistically, we shock February retail fuel prices across countries covering over 99% global demand to reflect a rise in oil prices to \$150/bbl and \$200/bbl, although with a smaller pass through in EMs to reflect the potential for price controls, and then calculate the share of 1Q22 GDP that such higher oil prices would represent at 2021 oil demand levels. This simple screens points to Europe and India as facing the largest income shock from increases in oil prices.

Exhibit 17: Rapidly growing oil consumption per capita and weaker FX in some EMs (e.g. Brazil, India) has offset rapid per-capita GDP growth (unlike China)

Estimated fuel expenditure share of GDP (%)



Source: Haver, EIA, GPP, Eurostat, Wind, Goldman Sachs Global Investment Research

Exhibit 18: Retail gasoline prices relative to GDP remain low in the US compared to the rest of the world, especially Europe, India, and Brazil

Retail road fuel prices (weighted by diesel, gasoline) in nominal and relative terms at current and hypothetical Brent prices (\$/litre)

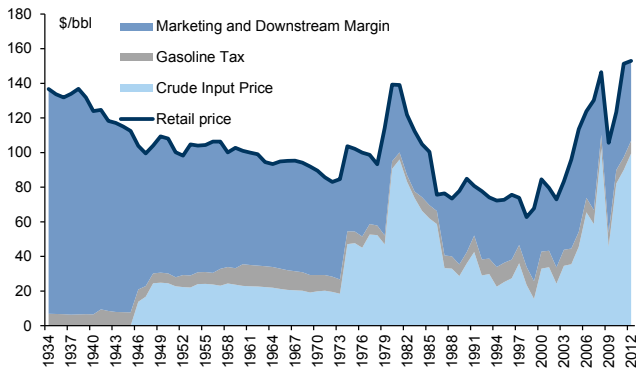
Country	Price (\$/l, Feb-22)	Road Demand (kb/d)	Nominal GDP (\$trn)	% Nominal GDP	Retail Brent beta	Implied retail price			Implied %Nom GDP		
						\$100/bbl Brent	\$150/bbl Brent	\$200/bbl Brent	\$100/bbl Brent	\$150/bbl Brent	\$200/bbl Brent
Global	1.17	41333	79.3	3.5%	94%	1.21	1.50	1.80	3.6%	4.5%	5.4%
DM	1.30	23843	49.1	3.7%	106%	1.34	2.30	2.64	3.8%	6.5%	7.4%
US	0.98	11853	21.4	3.1%	97%	1.02	1.32	1.63	3.3%	4.2%	5.2%
Europe	1.84	6792	15.6	4.6%	125%	1.89	2.28	2.68	4.8%	5.8%	6.7%
JP/KR	1.43	1946	6.7	2.4%	97%	1.46	2.34	2.65	2.5%	3.9%	4.5%
AUNZ	1.27	735	1.6	3.4%	117%	1.31	2.37	2.73	3.5%	6.3%	7.3%
Other OECD	1.23	2517	3.7	4.9%	104%	1.27	2.21	2.54	5.0%	8.8%	10.1%
EM	1.00	17490	30.2	3.9%	78%	1.02	1.73	1.98	3.4%	5.8%	6.6%
China	0.97	4962	14.3	2.0%	91%	1.01	1.29	1.58	2.0%	2.6%	3.2%
India	1.27	1922	2.9	4.9%	91%	1.30	1.59	1.87	5.1%	6.2%	7.3%
Brazil	1.19	1885	1.9	6.9%	95%	1.22	1.52	1.82	7.1%	8.9%	10.6%
Russia	0.63	1202	1.7	2.6%	36%	0.65	0.76	0.87	2.7%	3.1%	3.6%
Other EM	0.95	7520	9.5	4.4%	69%	0.98	1.60	1.82	4.5%	7.4%	8.3%

Source: Haver Analytics, GPP, EIA, Goldman Sachs Global Investment Research

- These elasticities are however ill-suited for a potentially record large supply shock and further, do not capture the potential for retail price interventions. For example, from 1973 to 1980, oil prices rallied 320% yet US consumer spending on energy only rose from 4% to 6.5% of income with retail gasoline prices only rising 88%, as refining margins and gasoline taxes both compressed. With retail prices ultimately the key binding constraint on consumption, a similar sharing of the redistribution of income would significantly increase the required rally in crude oil prices. For example, c.55% of European gasoline prices are tax, leaving for 130 EUR/bbl upside to current prices (without a change in pump prices), should taxes hypothetically be scrapped. This then becomes a trade-off between limiting the surge in retail fuel prices, at the expense of tax revenues, and economy wide goods inflation, spreading the demand adjustment across the consumption basket rather than solely on oil.

Exhibit 19: A large share of retail prices comes from margins and taxes (especially in Europe) that can be compressed in order to ease the pain on consumers

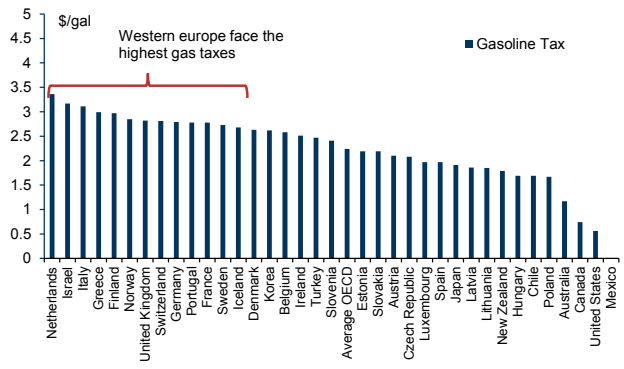
Real US gasoline prices (USD/bbl) by component



Source: EIA, DOE, Haver Analytics, Goldman Sachs Global Investment Research

Exhibit 20: European gasoline taxes are multiples of the levels in North America

OECD gasoline tax rates (USD/gal)



Source: IEA, Goldman Sachs Global Investment Research

Squaring the unknown - a probability weighted approach to solving the global oil market

Net, the oil market is faced with a potential large and long supply shock from Russia. The West will want to avoid such an outcome, but the global isolation of Russia could drive it instead to want to reduce its energy exports to close its current account. China, in our view, will hold the crucial role of choosing how the oil market will need to rebalance, and how much Russian oil seaborne exports end up shrinking. Supply will respond but this will be politically driven, between further SPR releases, a core-OPEC surge and a potential lift of sanctions on oil imports from Iran and Venezuela. While all these could help offset a sizable decline in Russian seaborne exports, this would leave the global oil market with no buffer, still requiring demand destruction through higher prices.

The uncertainty on how this conflict and potential oil shortages would be resolved is unprecedented. To provide a framework for where oil prices may trade, we build three price scenarios based on our above mapping of the oil rebalancing process. Our binding constraint to set prices remains the one we adopted earlier this year, with spot and long-dated prices needing to normalize OPEC spare capacity and global oil inventories over a one-year horizon, as previously occurred during all priors of such critical twin shortages.

- We begin with our latest forecast ('Prior base case') which incorporated an accelerated demand-led rebalancing, a pending Iranian nuclear deal, but limited disruption to Russian exports. We then consider a scenario where Russian exports settle 2 mb/d lower (consistent with Western self-sanctioning for example) and finally one of severe disruptions where exports remain reduced by 4 mb/d (on Western secondary sanctions or Russian self-imposed export restrictions). In the short-term, and for an assumed shortfall in Russian exports, we then map the expected supply responses from core-OPEC, IEA emergency reserves, and potentially barrels released from currently sanctioned countries or governments.

This allows us to then estimate the immediate remaining demand destruction required.

- From a pricing perspective, oil will then need to reflect the diminished level of OPEC spare capacity (\$15/bbl per 1 mb/d) as well as the short-run demand destruction (\$30/bbl per 1 mb/d) once the supply options have been deployed. To map 2023 prices, we retain our prior framework that prices will, through the roughly equal combination of shale supply and demand elasticity this time, solve for a normalization in both global inventories and OPEC spare capacity by 2H23.
- A normalization in export flows would lead us to reiterate our \$115/bbl Brent spot forecast for 2022. The loss of 2 mb/d would in turn bring spot prices to \$145/bbl while the larger loss of 4 mb/d would require prices reaching \$175/bbl. **Given a still intensifying military conflict, escalating Western sanctions and growing isolation of Russia, our subjective probability weighting of such outcomes (45%/40%/15%) reflect a disruption of 1.6 mb/d. The non-linearity in price responses, however, points to a higher probably weighted forecast than under such a modal outcome, leading us to raise our 2022 Brent spot price forecast to \$135/bbl, with our 2023 forecast at \$115/bbl.**
- While we acknowledge that the range of possible outcomes remains extreme, we also believe that current market forwards, especially long-dated prices, do not reflect the likely size of Russia's production shock on the global oil market. We finally acknowledge the potential for prices to remain quite volatile and potentially overshoot, with further a path dependency to 2023 prices given the inherent lagged supply and long-run demand responses. We nonetheless reiterate our view that long-dated oil prices remain significantly under-priced, still below our pre-Ukraine escalation forecast.

Exhibit 21: We shift to a probability weighted forecast given large uncertainties and positively skewed price outcomes

Scenario analysis for our probability weighted Brent price forecasts

Probabilities	45%	40%	15%	Probability weighted outcome	
	Prior base-case	Quotas and waivers	Full blockade/ Capital account closure		
2Q22	mb/d	mb/d	mb/d	mb/d	
Russia disruption	-0.50	-2.00	-4.00	-1.63	
Core-OPEC	0.00	0.75	1.50	0.53	
IEA SPR	0.00	0.30	0.60	0.21	
Iran	0.50	0.50	0.50	0.50	
Venezuela	0.00	0.00	0.20	0.03	
Residual demand destruction	0.00	-0.45	-1.20	-0.36	
Prior spot Brent base case (USD/bbl)	125	125	125	125	
Lower OPEC spare capacity	-10	5	15	0	\$15/bbl per 1 mb/d
Additional demand destruction	0	15	35	10	\$30/bbl per 1mb/d
New spot Brent scenarios (USD/bbl)	115	145	175	135	
2023	mb/d	mb/d	mb/d	mb/d	
Russia disruption	0.00	-2.00	-4.00	-1.63	
Iran	0.50	0.50	0.50	0.50	
Venezuela	0.00	0.00	0.20	0.03	
Higher shale production	-0.25	0.75	1.65	0.55	
Additional demand destruction	0.25	-0.75	-1.65	-0.55	
Prior 2023 Brent base case (USD/bbl)	105	105	105	105	
Required for higher shale production	-5	10	25	8	\$15/bbl per 1 mb/d
Required for additional demand destruction	-5	10	25	8	\$15/bbl per 1 mb/d
New 2023 Brent scenarios (USD/bbl)	95	125	155	115	

Notes:

Volumes are average 2022 numbers (mb/d), Prices are USD/bbl Brent

Iran 0.5 mb/d impact vs. base case in 2022/23, as given prior 50% probability of deal in 2023

2023 assumes IEA SPR release stops and Core-OPEC ramp is reversed, replaced with lower demand and higher shale supply

Spot price forecasts are rounded to nearest \$5/bbl

Source: Goldman Sachs Global Investment Research

Exhibit 22: Our oil forecasts remain above market forwards

\$/bbl

	Brent spot			WTI spot			Brent-WTI		
	New	Prior	Fwd	New	Prior	Fwd	New	Prior	Fwd
2Q22	135	100	114	127	97	108	8.0	3.0	6.3
3Q22	135	100	106	127	97	99	8.0	3.0	6.9
4Q22	135	100	101	127	97	94	8.0	3.0	6.3
1Q23	115	105	97	110	101	92	5.0	4.0	5.8
2Q23	115	105	95	110	101	89	5.0	4.0	5.8
3Q23	115	105	93	110	101	87	5.0	4.0	5.8
4Q23	115	105	91	110	101	85	5.0	4.0	5.7
2Q-4Q22	135	100	107	127	97	100	8.0	3.0	6.5
2023	115	105	94	110	101	88	5.0	4.0	5.8
3m	135	94.1	118	127	85	112	8.0	9.1	6.0
6m	135	80	108	127	77	101	8.0	3.0	6.9
12m	115	80	96	110	77	90	5.0	3.0	5.9

Source: CME, ICE, Goldman Sachs Global Investment Research

A potential dramatic reshape of the global energy landscape for the coming decades

- The energy shock created by Russia will change energy policy and planning in coming years, in our view. The EU will soon announce its energy roadmap and has reportedly shifted its short-term focus from decarbonization to energy security, likely relying for now on more coal, more nuclear, and gas generation, and overall allowing for more carbon emissions (consistent with the sharp sell-off in European carbon prices over the past week of nearly 30%). This should prove to be a significant positive for US and core-OPEC energy output in coming years, and the price induced

accelerator of the energy transition for the following decade.

- The geopolitical and energy consequences of any potential resolution further complicate the path to de-escalation. For example, any unwind of sanctions on certain OPEC members and the surge in core-OPEC and, eventually, shale production could sharply reduce the world's reliance on Russian oil exports in a couple of years, a potential compelling opportunity for the West. In addition, the accompanying years of historically high oil prices could in turn precipitate the transition to electrification. While governments would not be achieving this through the benefit of carbon taxes, this would nonetheless prove the necessary catalyst for material change in consumer energy consumption patterns, as occurred after the oil shocks of the 1970s.

Appendix - Russian oil balance

Exhibit 23: Russia net exports over 6 mb/d of oil to the world by boats, which are no longer moving

Russia oil balance breakdown (mb/d)

Crude	mb/d	Notes
Production	11.0	Jan-22 crude and condensate ex NGLs
Exports	5.0	Production less Runs
Europe	2.7	Average last 3m
Of which pipe	0.8	News flow
US	0.2	Average last 3m
China	1.4	Average last 3m
Of which pipe	0.5	News flow
Others	0.6	Notable: Japan, Korea
Runs	6.0	Jan-22
Products	mb/d	Notes
Demand	3.7	1Q22 Gse
Product exports	2.3	Runs minus demand*
Europe	1.6	Average last 3m
US	0.2	Average last 3m
China	0.2	Average last 3m
Others	0.3	Notable: Korea, Saudi, UAE

* c. 1mb/d fuel oils/VGO/interm., c.1mb/d distillates, c.0.5 mb/d light ends

Source: Kpler, Bloomberg, Reuters, IEA, Petro-logistics, Goldman Sachs Global Investment Research

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Reg AC

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