

GLOBAL ECONOMICS ANALYST

Assessing Global Growth Risks from Middle Eastern Supply Shortages

- Three months into the Iran War and despite ongoing negotiations, transits through the Strait of Hormuz remain depressed. While global growth has so far held up reasonably well, concerns persist that it is just a matter of time before accumulating supply shortages lead to outsized reductions in activity. In this *Global Economics Analyst* we evaluate the economic impacts of a risk scenario where persistent closure of the strait leads to an indefinite loss of Middle Eastern commodity supplies.
- We continue to expect that most of the demand destruction required to clear markets will be driven by prices, which have risen sharply for highly exposed products. This is especially true for oil, where we continue to see our growth rules of thumb as appropriate. That said, if supply constraints were to start binding for oil, the growth impacts could rise beyond the 1-1.5% implied by our severely adverse price scenario.
- The bigger risk of outright stockouts probably resides with non-oil commodities, where markets are less global and supply is often regional. Non-oil commodity supply from the Middle East only accounts for 1.3% of global GDP, but under an extreme assumption in which each input is critical and output in each industry declines in proportion to the binding commodity supply restriction—what economists call a Leontief production function—supply losses could drive very large reductions to output.
- There are three reasons why we would expect the growth hit to remain more contained, however. First, the implied GDP hit falls sharply when we exclude inputs that account for a trivial share of production. Second, reallocation of scarce inputs from low- to high-value-add uses materially lowers the drag. Third, even modest substitutability across inputs lowers it further. Under reasonable assumptions for each channel, we estimate the direct growth headwinds from non-oil supply disruptions could lower global GDP by 0.4-0.5%, with downstream supply impacts moderately amplifying these impacts.
- Data so far appears to align with these predictions, as anecdotes suggest that demand destruction has skewed toward lower-income countries and lower-value added industries, and industrial production data has yet to show signs of binding supply constraints. Moreover, supply-constrained product prices have retraced somewhat in recent weeks.

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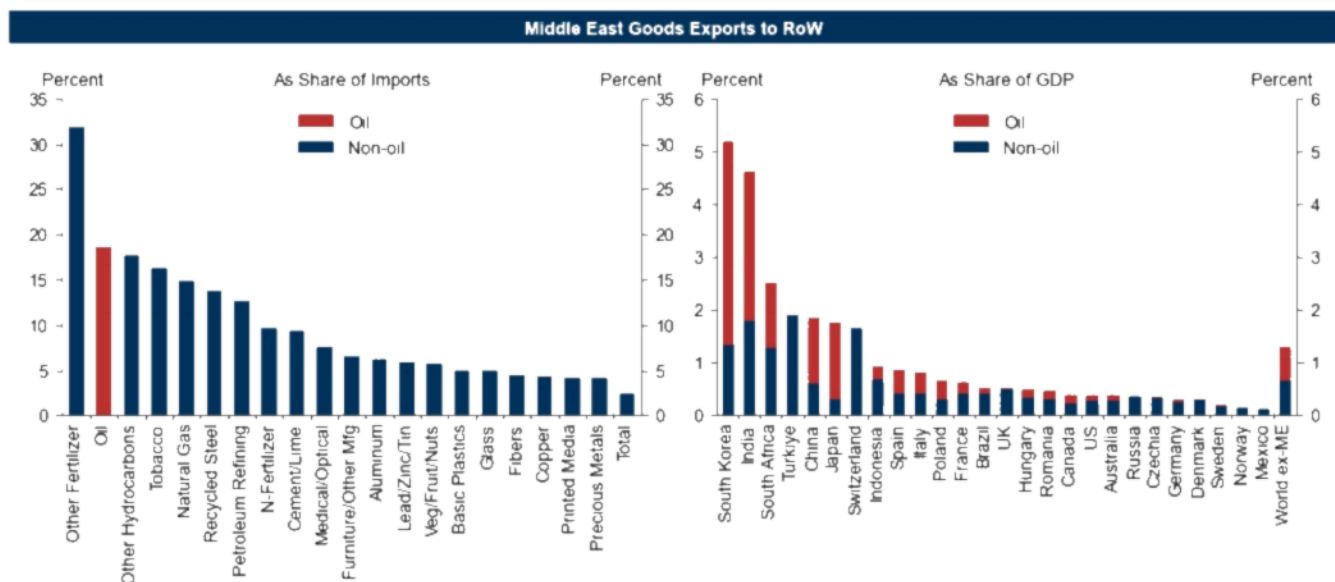
Assessing Global Growth Risks from Middle Eastern Supply Shortages

Three months into the Iran War and despite ongoing negotiations, transits through the Strait of Hormuz remain depressed, with reported vessel counts down over 90% from normal levels. Our baseline commodity and economic forecasts assume a normalization in Gulf exports by end-June, but risks appear increasingly skewed towards a longer supply disruption.

Exports from the Persian Gulf account for sizeable shares of global trade in several key industrial and agricultural inputs—most notably oil, but also fertilizers, natural gas, refined products, petrochemicals, steel and aluminum (Exhibit 1). While we argued shortly after the start of the war that the supply shock would be manageable and mostly limited to energy, the extended supply disruption has raised concerns that accumulating shortages and production bottlenecks could be more disruptive to the global economy.

Against this backdrop, in this *Global Economics Analyst* we model an indefinite loss of Middle Eastern commodity supplies to estimate the GDP headwind if supply constraints increasingly become binding.

Exhibit 1: Exports from the Middle East Account for a Large Share of Global Trade in Certain Key Industrial and Agricultural Inputs, Although Their Share of Global GDP is Smaller

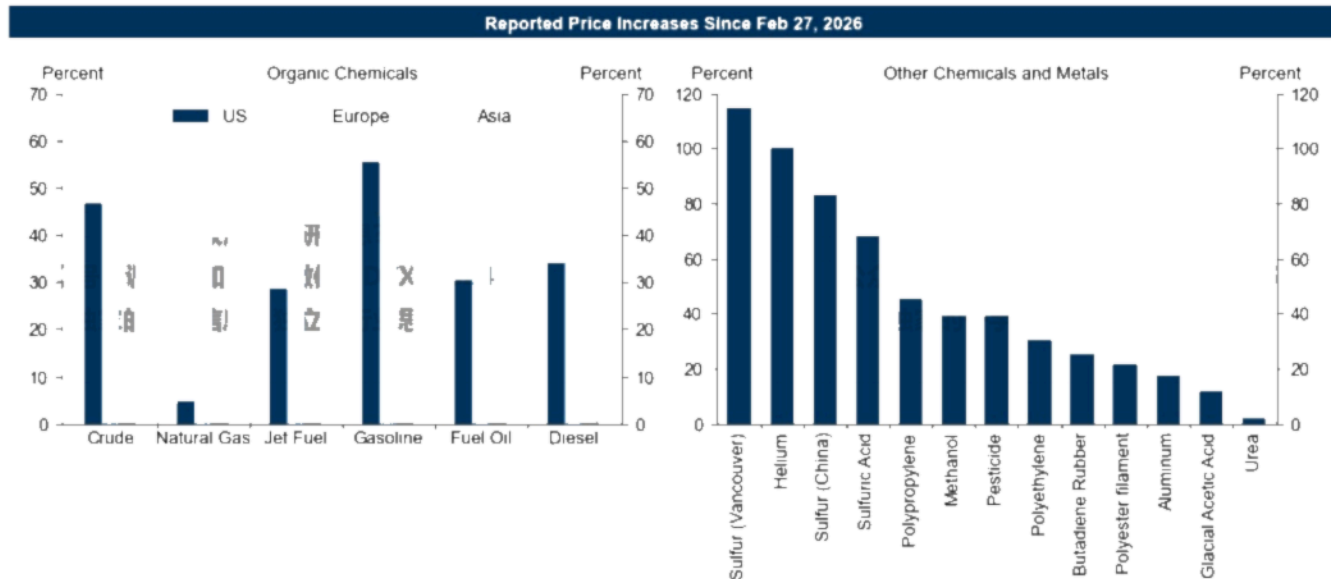


Source: Exiobase, Goldman Sachs Global Investment Research

We continue to expect that most of the demand destruction required to clear markets will be driven by prices, which have risen sharply for highly exposed products (Exhibit 2). Crude oil prices have risen by up to 50%, with even larger increases for refined products like gasoline, jet fuel and diesel (Exhibit 2, left). At the same time, base chemical prices rose more than 60% from the start of the conflict to April, the fastest rate ever recorded. Spot prices for helium—a byproduct of natural gas extraction and an indispensable input for cryogenic applications including semiconductor production—are reported to have doubled since the start of the conflict (though the majority of the industry works on contract pricing that is up much less). Sulfur and sulfuric acid, key inputs for copper refining, phosphate fertilizer and titanium dioxide production, are up over 60%, while methanol—a critical feedstock for a range of petrochemicals including formaldehyde

and acetic acid—is up 40% ([Exhibit 2, right](#)).

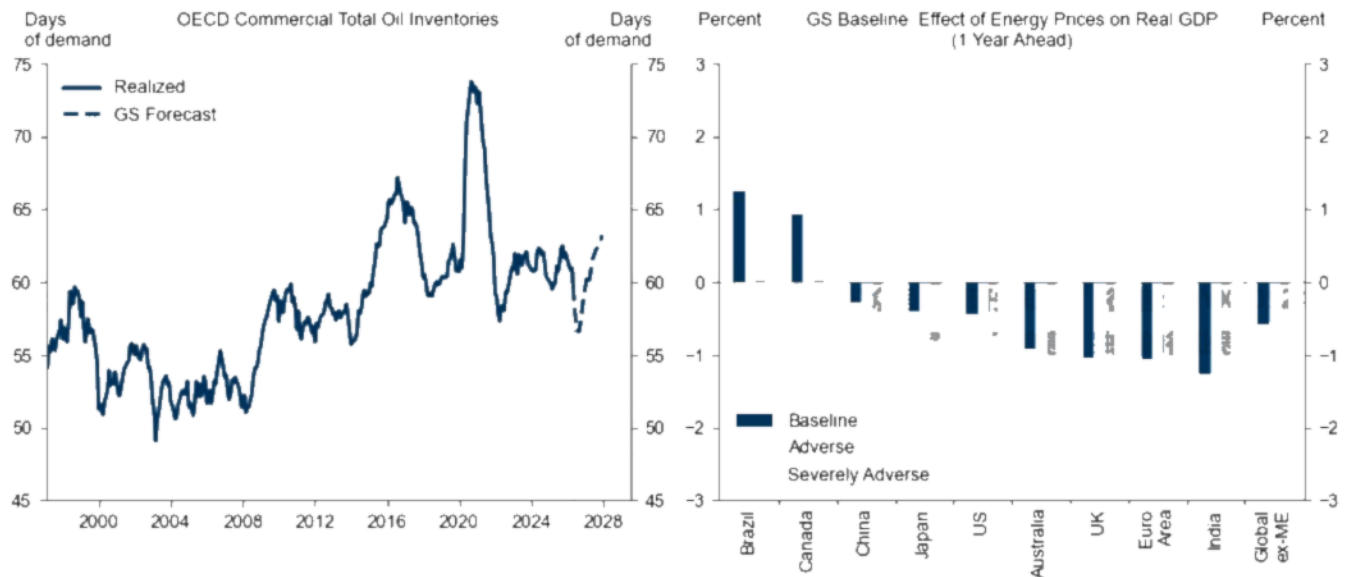
Exhibit 2: Commodity Prices Have Surged In Response to the Supply Shock



Source: ICE, Platts, Haver Analytics, Goldman Sachs FICC and Equities, Trading Economics, CNBC, Goldman Sachs Global Investment Research

Our expectation that price increases will destroy enough demand to avoid outright stockouts applies especially to oil. While oil inventories are being drawn down rapidly, under our baseline forecasts OECD commercial oil inventories remain above pre-shale averages, although [commercial products inventories](#) are lower. Against this backdrop, we continue to see our [standard rules of thumb](#)—particularly those [adjusted](#) for natural gas price increases—as providing a valid guide to the hit to GDP from higher energy prices. Currently our growth estimates and baseline commodity forecasts imply a 1/2pp hit to GDP, although the drag could rise dramatically if supply remains curtailed for much longer ([Exhibit 3](#)).

Exhibit 3: Crude Inventories Remain Above Historical Levels Despite Rapid Drawdowns; Our Rules of Thumb Capture the Growth Impact of Demand Destruction via Higher Prices



Source: Goldman Sachs Global Investment Research

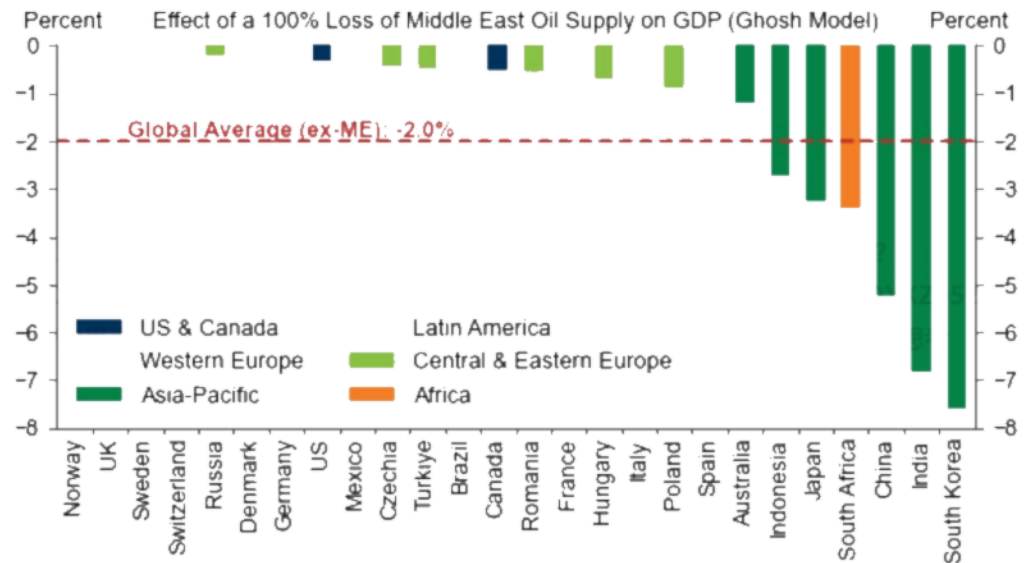
A Quantity-Based Approach to the GDP Impacts from Supply Reductions

A complementary approach to assessing the growth downside from supply disruptions is to look at quantity losses rather than price increases. This approach is agnostic to the price increases necessary to lower commodity demand enough to match supply, while potentially providing useful insights into where GDP hits could emerge due to supply shortages when markets are less global and regional dynamics matter more.

To implement this quantity-based approach, we leverage the Exiobase IO tables, which measure the supply linkages for 200 products in 163 industries across 44 countries. These tables allow us to measure not only the direct impacts from loss of Middle Eastern commodity supplies, but also the indirect effects on downstream industries. In all subsequent analysis we use these mapped linkages to simulate a complete loss of Middle Eastern supply without considering potential offsets from inventory drawdowns.

To start, [Exhibit 4](#) shows the potential impact of a complete loss of Middle Eastern crude oil supply under the assumption that each downstream sector reduces its output in proportion to its direct and indirect Middle Eastern oil consumption. This exercise implies that around 2% of global GDP is dependent on Middle Eastern oil supply—reflecting a reliance on oil both as a source of energy and petrochemical feedstocks (over 95% of manufactured goods contain petrochemicals)—with South Korea (~8%), India (~7%) and Mainland China (~5%) especially exposed to oil supply losses. As noted above, however, oil stockouts are less likely given the global nature of oil markets where an outsized price increase would likely be sufficient to destroy demand.

Exhibit 4: A Complete Loss of Middle Eastern Crude Oil Supply Would Likely Lower Global GDP by 2%



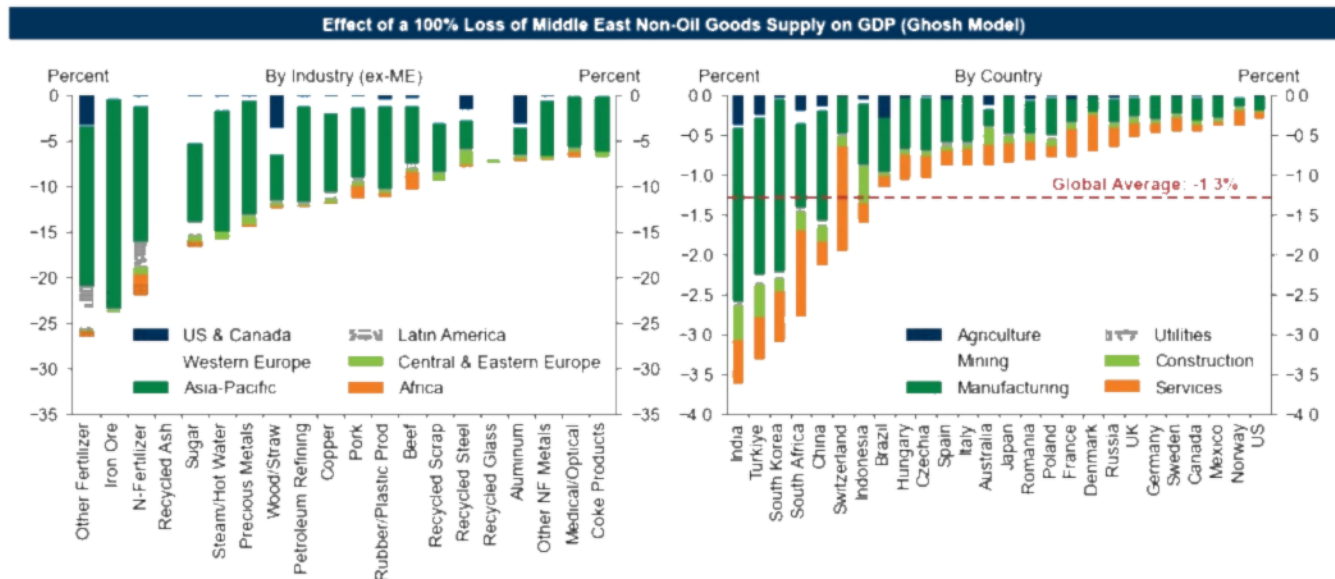
The Ghosh model assumes that each downstream sector reduces its output in proportion to its direct and indirect consumption of the shocked inputs.

Source: Exiobase, Goldman Sachs Global Investment Research

For other refined products and chemicals, supply and stockout concerns are more pressing. Our commodities strategists see the largest shortage risks for petrochemical feedstocks (particularly naphtha), diesel and jet fuel. Shortage risks are particularly acute for diesel, where demand is highly price-inelastic given its importance in industrial applications and limited available substitutes. Across countries, South Africa, India and Taiwan appear most at-risk given large reductions in local product supply and relatively low crude stocks. On the chemicals side, some Asian petrochemical plants have already declared *force majeure*, and our analysts warn that supply disruptions could extend through to 2027 even if the Strait of Hormuz opens imminently.

We therefore repeat the analysis in Exhibit 4 for non-oil exports from the Middle East in Exhibit 5. Indefinite loss of supply of these products would reflect an 0.7% loss of global non-oil imports and 1.3% hit to global GDP—led by declines in India (-3.6%), Turkiye (-3.3%) and South Korea (-3.1%)—under the assumption that downstream output is proportionally affected.

Exhibit 5: Downstream GDP Exposure to Middle East Goods Supply Ranges from 0.3% in the US to Over 3% in India, Turkiye and South Korea



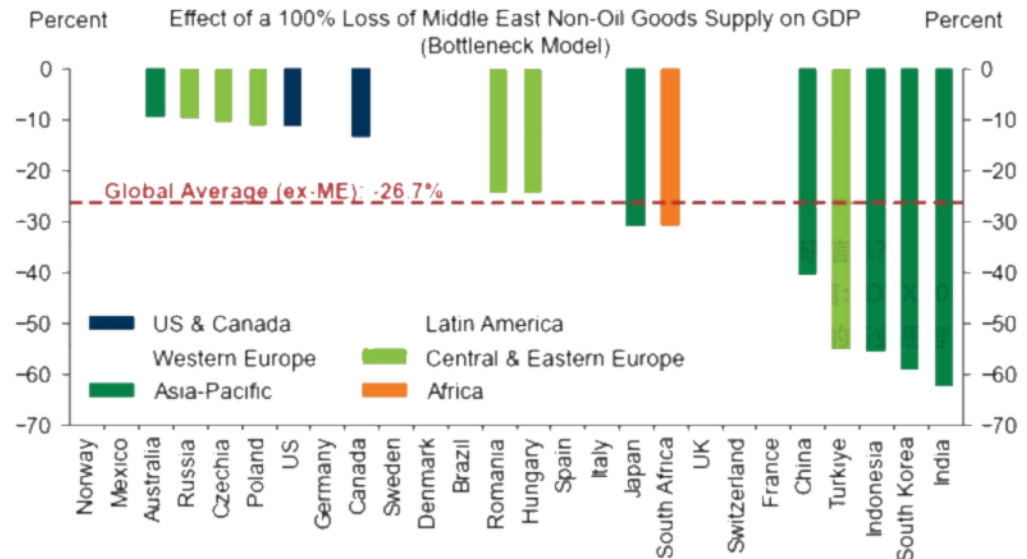
The Ghosh model assumes that each downstream sector reduces its output in proportion to its direct and indirect consumption of the shocked inputs.

Source: Exiobase, Goldman Sachs Global Investment Research

While these losses are notable, a key lesson from the supply disruptions after the pandemic is that product shortages can create critical chokepoints that propagate through supply chains, thereby reducing output by a larger amount than the share of lost inputs. These dynamics have been of particular concern to investors, since amplified supply reductions (particularly due to limited chemical supplies) could lead to much sharper increases in prices of downstream goods, as was the case for global semiconductor shortages in 2021-2022.

To shed light on these concerns, we repeat our analysis using a bottleneck model of production (formally, a Leontief production function) where a 10% loss of supply of any input leads to a 10% reduction in output in the receiving sector, regardless of whether other inputs are available. Under this more extreme assumption, each input is critical and cannot be substituted, and production is constrained by the input made most scarce due to the loss of Middle East supply. Under this extreme assumption, the hit to global GDP would rise to 27%. Moreover, if we allow these effects to cascade along supply chains, then almost all output would eventually be lost. This is because if just one industry relies entirely on the Middle East for supply of any one of its inputs (no matter how small a share of production it accounts for), that industry, and all industries which depend on it, would cease production under a Leontief production function. Given how interconnected global supply chains are, these effects quickly propagate throughout the global economy.

Exhibit 6: In an Extreme Scenario Where Goods from the Middle East Are Critical for Production and No Opportunities for Substitution Exist, the Growth Impact Would Be Severe



Source: Exiobase, Goldman Sachs Global Investment Research

Many Margins of Adjustment

While the bottleneck model highlights the possibility that binding supply constraints could be very problematic, we expect the impacts on the overall economy will be much more limited since households and businesses have many margins of adjustment.

As a recent precedent, when Russian gas supplies to Europe were completely cut off, the resulting impact on GDP was far less severe than some forecasters had initially feared, largely because firms and households adapted their behaviour in response to the shock more effectively than expected. As highlighted by [Moll et al \(2023\)](#)'s retrospective on the German gas shortages, the most pessimistic forecasters anticipated a 12% hit to GDP due to the loss of supply, while in reality Germany experienced only a slight technical recession. Significantly, adjustments by households and firms meant that the hit to industrial production was largely contained within the most exposed sectors, with the German economy avoiding the cascading effects highlighted above which could wipe out entire supply chains. In the analysis that follows, we therefore focus primarily on the first-round effects of supply shortages.

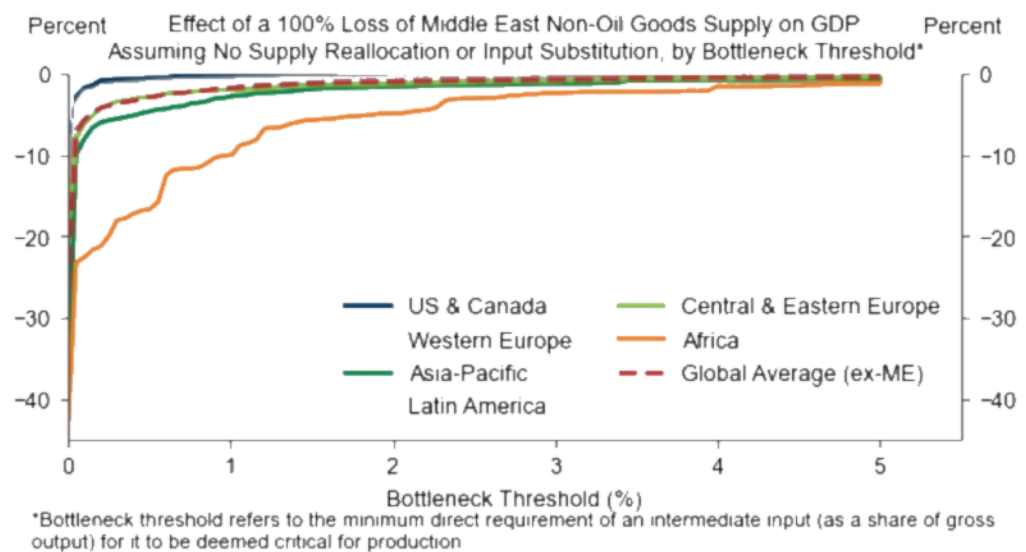
Even if non-oil supply from the Middle East were permanently curtailed, we would expect the global economy to respond similarly to limit the impacts on activity. Below, we highlight three key margins of adjustment that could mitigate the effects of a complete loss of exports from the Persian Gulf.

Mechanism 1: Cutting consumption of 'non-critical' inputs

The assumption in the bottleneck model that all inputs are critical for production is very strong, and for some inputs, supply losses are likely to have only a tiny effect on output. As an example, the Japanese food manufacturer Calbee has switched to black-and-white packaging due to shortages of naphtha, a key ingredient in ink production.

To quantify how rapidly the hit to global GDP diminishes after allowing for non-critical inputs, in [Exhibit 7](#) we maintain our bottleneck model but relax the critical input assumption for inputs that account for less than a certain percentage of gross output. This exercise demonstrates that a large portion of the growth drag in the worst-case scenario is driven by industries with trivial exposure to Middle East supply. Raising the bottleneck threshold to just 0.01% of gross output would reduce the growth hit from 27% to 10%, while a threshold of 1% would imply only a 6% drag. In the analysis that follows, we continue to impose a 0.01% threshold, which we see as a conservative assumption. Allowing for non-critical goods also eliminates many of the cascading supply chain effects. If we account for all forward linkages, raising the bottleneck threshold to 1% reduces the growth hit by around a third, and raising it to 5% lowers it by over 95%.

Exhibit 7: The Growth Impact Would Be Much Smaller If Goods That Account for a Trivial Share of Overall Inputs are Non-Critical for Production



Source: Exiobase, Goldman Sachs Global Investment Research

Mechanism 2: Supply reallocation

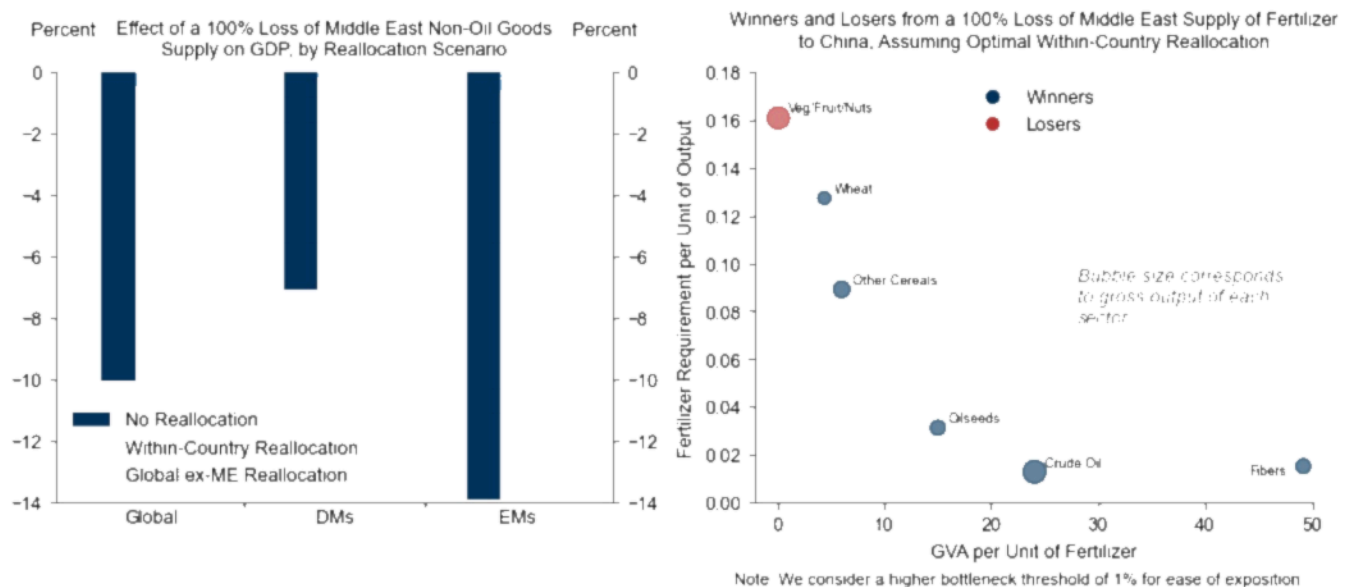
Second, we expect higher prices will help reallocate resources towards their most productive uses, thereby diminishing the overall GDP hit.

For example, helium is a crucial input for the semiconductor industry but around 5-7% of global supply is used for party balloons. Higher prices would likely redirect helium supply from partygoers to semiconductor manufacturers with little cost to output. Such reallocation dynamics are already playing out. In Asia, our [chemicals analysts](#) have flagged that production cuts due to petrochemical shortages have mostly been concentrated to low value-added sectors like textiles and packaging. Similarly, Europe is successfully redirecting US jet fuel flows away from Asian EMs by bidding up prices.

In [Exhibit 8](#) (left), we present the results of a simple model (maintaining our bottleneck production function) where supply is optimally reallocated across industries to minimize the hit to GDP. We consider three scenarios: no reallocation, within-country reallocation and global reallocation. In our model, reallocating resources within countries dampens the growth hit from 10% to just 0.4%, while frictionless global reallocation reduces the hit to less than 0.1%.

Exhibit 8 zooms in on the loss of all phosphate fertilizer supply from the Middle East to China to illustrate why reallocation significantly dampens output losses. In this illustration, we assume that fertilizers can be reallocated within China but do not allow for import substitution. We then highlight sectors that are reallocated more or less fertilizer (compared to a scenario with no reallocation). As shown in the chart, supply is diverted away from industries where fertilizer accounts for a large share of costs but generates lower value added (e.g., vegetables and nuts) toward industries where fertilizer accounts for a tiny share of costs but higher value added (e.g., plant-based fibers). While this example does not consider the welfare costs of a reduction in food supply (as well as the likely significant upward pressure on food prices) that may also factor into supply allocation decisions, it highlights how reallocation can help address supply shortages in some industries.

Exhibit 8: Diverting Supply to Higher Value-Added Industries Could Reduce the Global GDP Hit from 10% to Less than 1%



Source: Exiobase, Goldman Sachs Global Investment Research

In practice, the amount of reallocation will depend on individual products. Some products like aluminum have deep global markets that will facilitate reallocation across countries and industries, whereas regional supply dynamics and contract structures will limit natural gas reallocation in some countries. Nevertheless, the results above highlight that supply reallocation can be very effective in dampening the overall GDP hit from loss of Middle East supply. Moreover, supply reallocation can play a key role in dampening the cascading effects of supply losses. Amending our model to account for all downstream linkages still yields less than a 0.2% hit to global growth in a world where global supply can be reallocated freely.

Mechanism 3: Substitution between intermediate inputs

Third, firms may be able to substitute between some intermediate inputs.

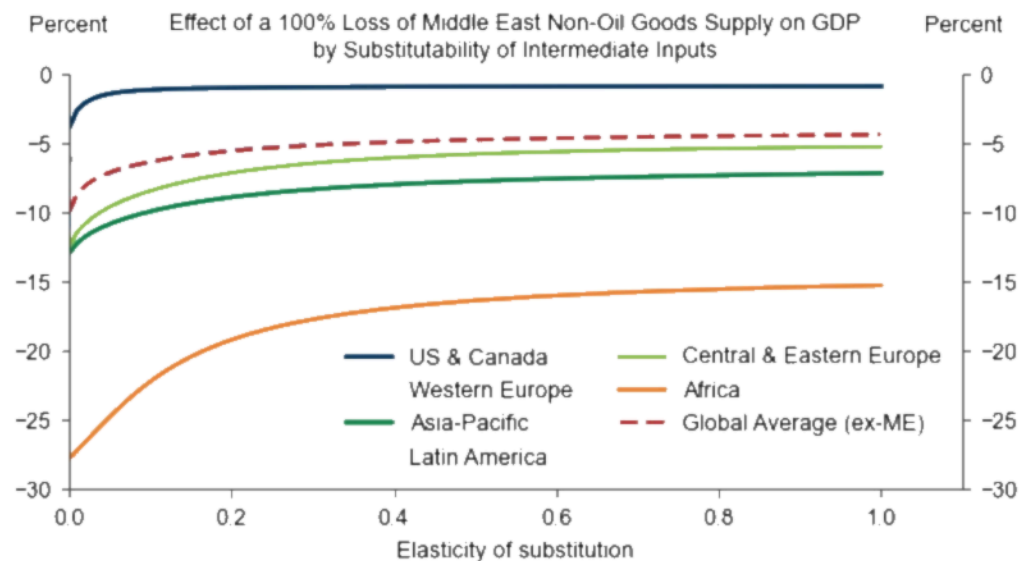
For instance, basic plastics such as polyethylene can be replaced by paper, glass or aluminum packaging. Environmental concerns and legislation in recent years have already prompted firms to find alternatives to single-use plastic: some more innovative solutions include supermarkets in Asia wrapping produce with banana leaves, and

cosmetics brands switching from traditional liquid shampoos to solid versions packaged in cardboard¹. The loss of plastics (and upstream feedstocks such as naphtha) could accelerate the rollout of such measures while leaving GDP little changed.

Admittedly, some products are likely less substitutable at the micro level. For example, it is difficult for individual petrochemical plants to substitute away from their respective feedstocks. Likewise, there are few satisfactory substitutes for sulfuric acid in copper refining and ore leaching. That said, at the industry level, the elasticity of substitution will likely be higher than it is for any individual plant, since firms employ varied production technologies, enabling supply reallocation within industries which can moderate growth impacts.

To model substitutability, in [Exhibit 9](#), we calibrate a constant elasticity of substitution (CES) production function to match the observed input-output linkages. As the elasticity of substitution increases from zero (Leontief) to 1 (Cobb-Douglas), the global growth hit declines from 10% to just less than 5%, with most of this reduction resulting from allowing for only a modest degree of substitutability.

Exhibit 9: Even a Small Degree of Substitutability Between Imports Would Dampen the GDP Hit Substantially



Source: Exiobase, Goldman Sachs Global Investment Research

Combining Margins of Adjustment

To assess the magnitude of the potential growth hit after accounting for these margins of adjustment, we make reasonable assumptions on the bottleneck threshold, ease of reallocation and substitutability of inputs, guided by the academic literature and our own judgement.²

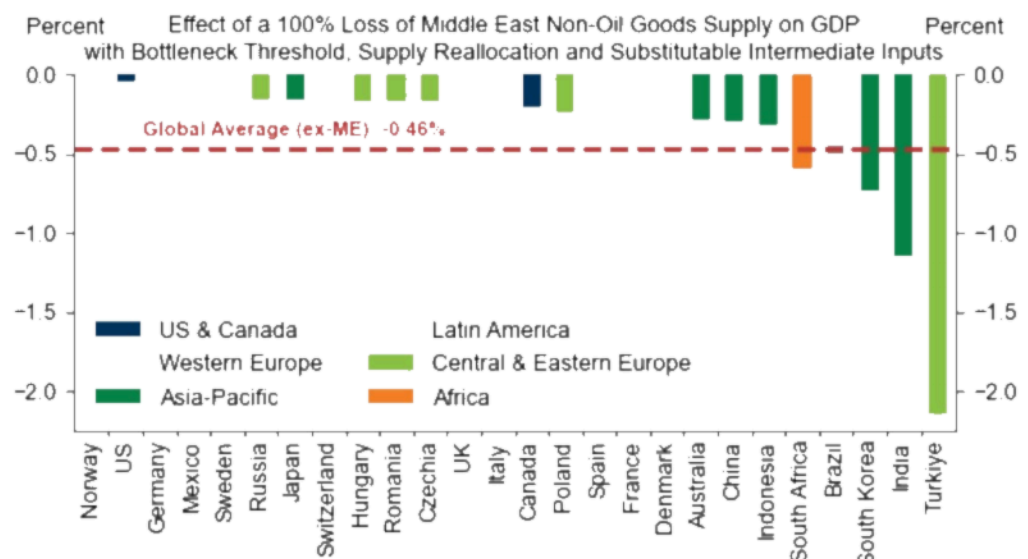
¹ See the online supplement to Bachmann et al (2022) for more examples of the innovative ways that firms have responded to historical supply shocks.

² We maintain our conservative 0.01% bottleneck threshold assumption. We assume that products which are highly specialized/regulated and products with short shelf-lives/complex logistics or other geographic constraints can't be reallocated in the short-run (this covers most food items, waste/recycling industries and some sectors like processing of nuclear fuel). Natural gas—which is delivered by pipeline or by tanker to specialized receiving terminals—can only be reallocated within countries. Low value quarrying products like stone are also only reallocated within countries given their low value-to-weight and high transportation costs.

Under these assumptions, we estimate that a complete loss of non-oil goods supply from the Middle East would directly lower global GDP by 0.4–0.5% (incremental to the hit from higher oil and gas prices shown in [Exhibit 3](#)), with the largest hits in Türkiye (2.2%) and India (1.1%). DMs such as the US and Norway would face much smaller growth hits (0.1% or less), reflecting their higher-value added production and lower dependence on Middle Eastern supply. While fully accounting for all downstream linkages would lead to a moderately larger GDP hit—simulations suggest up to three times as large—these impacts remain much smaller than the extreme scenario shown in [Exhibit 6](#) where all goods are critical, not substitutable, and no reallocation occurs.

While there is admittedly significant uncertainty how active each of these margins of adjustment will be in practice and we remain concerned that non-energy supply reductions could pose incremental challenges to growth in 2026H2 (particularly in [Asia](#), consistent with the predictions in [Exhibit 10](#)) our results highlight that adjustments to production and pre-existing supply chains can meaningfully dampen economic losses.

Exhibit 10: Under Reasonable Assumptions, We Estimate that a Complete and Persistent Loss of Non-Oil Goods Supply from the Middle East Would Directly Lower Global GDP by 0.4–0.5%



Source: Exiobase, Goldman Sachs Global Investment Research

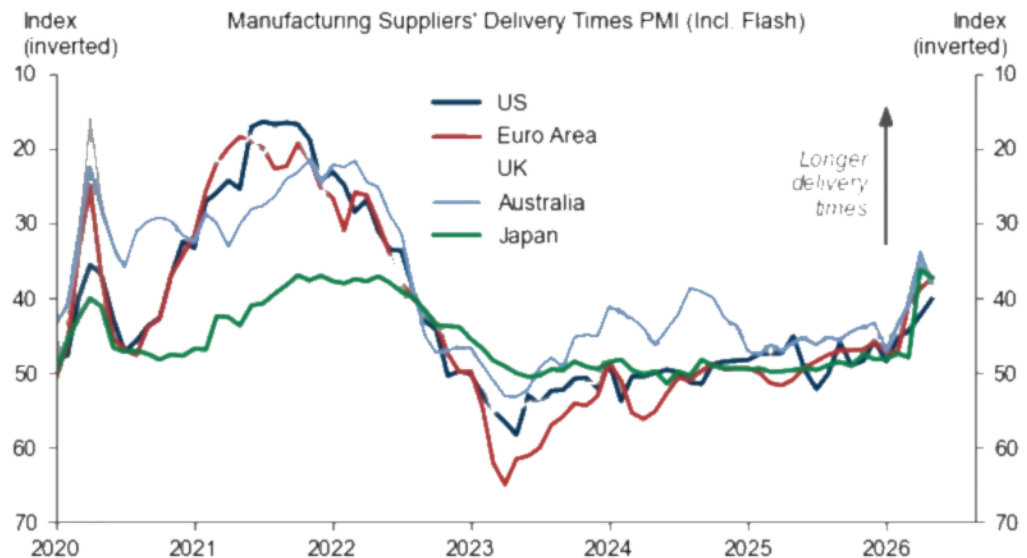
Our results also have implications for potential price increases. While prices of directly affected commodities will likely lead to significant upward inflation pressures, if adjustments keep downstream goods production mostly intact, extremely large price increases may be mostly avoided. For example, combining the implied reduction in [Exhibit 10](#) with our typical goods supply elasticity (-0.8) implies only 0.4pp upward pressure on core inflation from chemical and refined product shortages, incremental to the impact from higher energy prices (which we expect will raise global headline inflation by 1.0pp and core inflation by 0.3pp). While latent chokepoints leading to outsized price increases could still emerge, these results support our long-standing view that energy prices will remain the main driver of inflation.

We assume all other inputs can be reallocated globally. Lastly, we assume an elasticity of substitution between intermediate inputs of 0.1, consistent with Atalay (2017), who uses the changes in military spending as exogenous demand shifters to estimate this elasticity in the US.

What to Watch

As the conflict evolves, we will be closely watching business surveys as an early signal of supply chain stress. Manufacturing suppliers' delivery times have lengthened across countries over the last three months—Euro area delivery times saw the largest increase since 2022 in April—with commentary attributing this to the conflict in the Middle East. The New York Fed's Global Supply Chain Pressure Index—which incorporates signals from the manufacturing PMIs, as well as additional information on freight costs—also surged in April to its highest level since the pandemic. Initial PMI numbers for May point to ongoing delays in supply chains, with modest relief in Australia and Japan following large upticks in April ([Exhibit 11](#)).

Exhibit 11: Business Surveys Point to Emerging Supply Chain Stress



Source: Haver Analytics, Goldman Sachs Global Investment Research

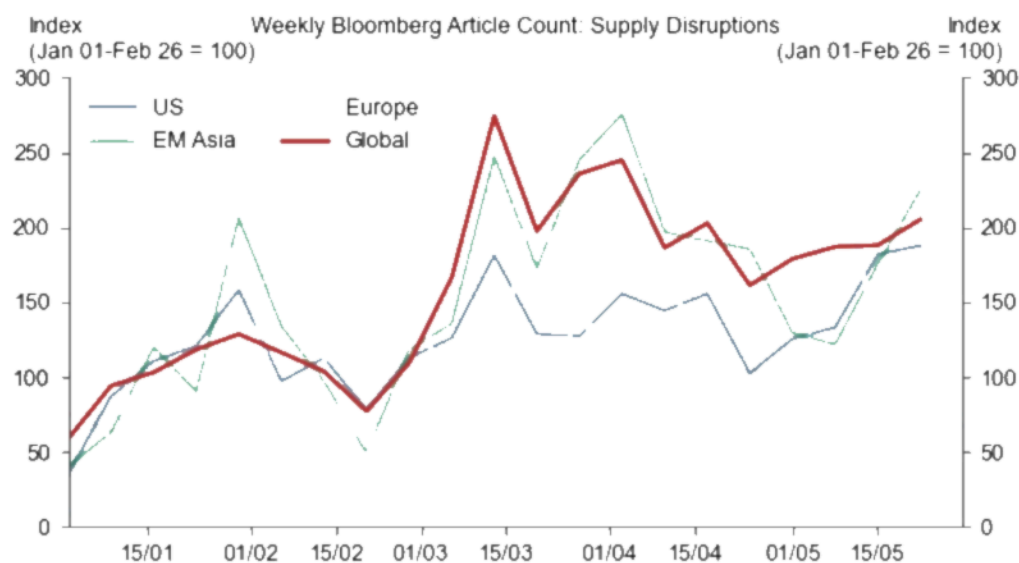
That said and consistent with our model results above, anecdotes suggest that production cutbacks so far have been skewed toward low value-added sectors and countries ([Exhibit 12](#)). Looking ahead, we will be watching closely for new anecdotes of output reductions further up the value chain. We will also be monitoring the industrial production (IP) data for signs that supply shocks are broadening out across supply chains, although these numbers are reported with more of a lag. Where we do have more timely IP data, the April numbers surprised notably to the downside in China, but with weakness mostly limited to sectors directly exposed to exports from the Middle East. Conversely, industrial production was stronger than expected in the US, consistent with our view that the US will remain relatively insulated from supply disruptions due to its limited dependence on Middle East exports and its ability to outbid poorer economies.

Exhibit 12: Anecdotal Evidence Suggests Supply Constraints May Be Starting to Bind in Some Sectors

Industry	Country/Region	Summary
Petrochemicals	India	- Reliance Industries cut aromatics production, which could result in a loss of 75,000 tonnes of paraxylene producer, according to ICIS estimates. - Bharat Petroleum Corporation Ltd halted production of acrylic acid and butyl acrylate at its Kochi plant. - The Gas Authority of India shut down its high density polyethylene (HDPE) and linear low density polyethylene (LLDPE) units in Uttar Pradesh. - Indian Oil Corp Ltd shut a polypropylene unit in Paradip amid polypropylene shortages. - Deepak Phenolics declared force majeure on its phenol and acetone plants.
	Indonesia	- Indonesian petrochemical manufacturer PT Chandra Asri Pacific declared force majeure
	Taiwan	- Taiwan's Formosa Petrochemical announced the implementation of force majeure on certain petrochemical products, including ethylene and propylene
	South Korea	- Yeochun NCC, the nation's largest ethylene producer, and other petrochemical manufacturers declared force majeure.
Textiles	India	- Textile weaving units in Surat have decided to restrict operations to a single 12-hour shift per day to curb production.
Fertilizers/Urea	India	- Manufacturers in India, including top producer India Farmers Fertiliser Cooperative Ltd, have shut down some of their facilities or moved up annual maintenance.
	Bangladesh	- Bangladesh Chemical Industries Corporation has shut four out of five of its urea factories due to gas rationing.
Steel	Europe	- ArcelorMittal and several other European long steel producers suspended sales of rebar, sections and wire rod.
Air Travel	Worldwide	- A number of airlines globally have announced flight reductions in response to higher jet fuel prices.

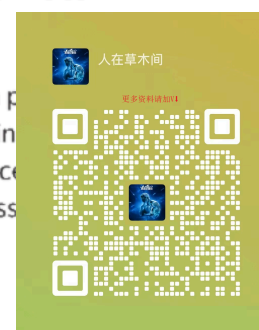
Source: ICIS, Bloomberg, Quantum Commodity Intelligence, Eurometal, Goldman Sachs Global Investment Research

To more systematically track reports of production shutdowns, in [Exhibit 13](#) we count the number of Bloomberg articles relating to both supply disruptions and specific regions. Following a surge in news articles at the start of the conflict, the news flow around production bottlenecks has slowed somewhat in recent weeks. While this may partly reflect 'news fatigue', we believe the retracing partly reflects a transition from panic-buying in the early stages of the conflict to destocking, while demand destruction is likely also playing a role in rebalancing markets and alleviating concerns around quantity constraints. Firms may have also started to find solutions to circumvent some of the logistical challenges which arose at the onset of the conflict.

Exhibit 13: News Reports of Supply Disruptions Have Slowed Somewhat in Recent Weeks but Remain Elevated

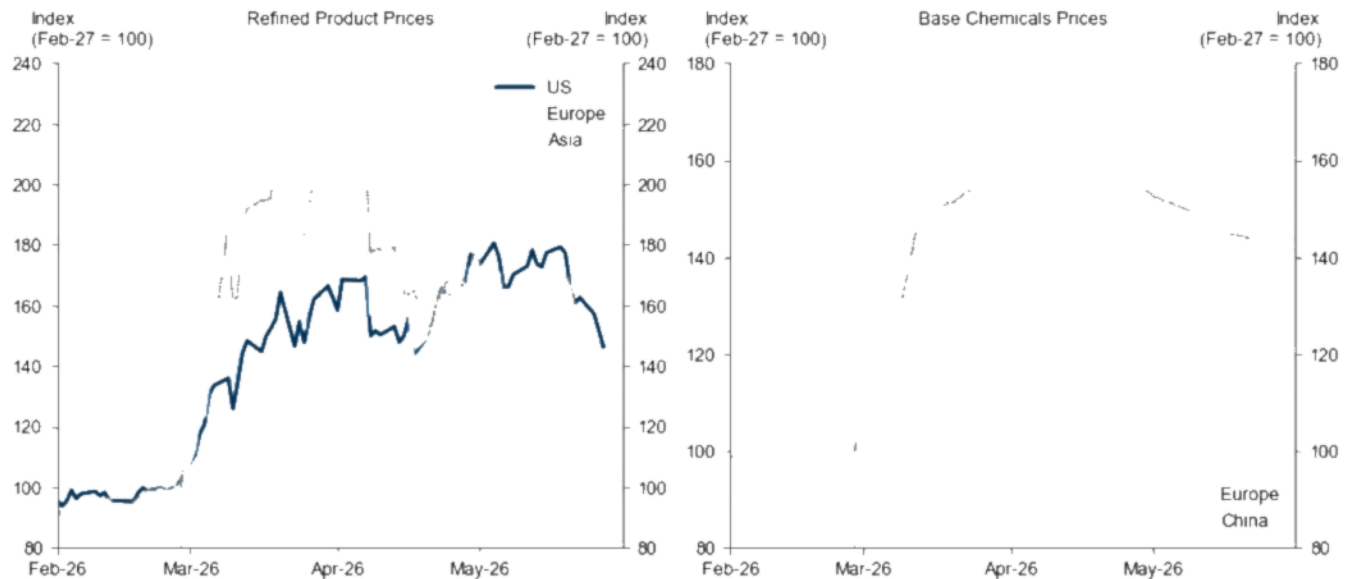
Source: Bloomberg, Goldman Sachs Global Investment Research

This narrative is consistent with recent moves in product prices, which provide a clear signal of supply/demand balances. [Exhibit 14](#) shows that prices remain elevated but have generally stabilized or moderated recently. While some of the recent price movement reflects a compression in risk premium and therefore should not necessarily



a signal that supply shortages are becoming less of a concern, a further leg up in prices from here would potentially signal renewed shortage concerns.

Exhibit 14: Prices for Exposed Products Have Retracted Following Outsized Gains at the Start of the Conflict



The refined products indices are averages of gasoline, diesel, jet fuel, fuel oil, and naphtha prices weighted by 2025 average demand shares of each product. The base chemicals indices are unweighted averages of contract prices for ethylene, propylene, benzene, styrene and methanol.

Source: Platts, Argus, Goldman Sachs Global Investment Research

The upshot is that both our model-based analysis and recent signals point to a moderate but contained hit to global growth from Middle Eastern supply disruptions.

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Disclosure Appendix

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