Commodity Insights

Timespreads Don't Lie; Copper Backwardation is Coming

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- We have long argued that timespreads—spot prices versus forward prices—do not lie about the physical tightness of the oil market. Extending this framework, we reach three conclusions.
- **Timespreads usually don't lie, especially for energy.** We find a negative and significant impact of coverage ratios—inventories as a share of demand—on timespreads across the 8 commodities we study. Low inventories boost timespreads the most for oil and natural gas because energy demand is very price inelastic in the short run.
- **Moving to steeper part of the curve and copper backwardation.** The relationship between inventories and timespreads is highly non-linear for industrial metals, including copper. The boost to timespreads from a drop in industrial metal stocks tends to be modest when stocks are within historical norms, but rises sharply when dropping to depletion level lows. Our metals team expects that large deficits from Q2 will push the copper market into the steep scarcity pricing part of the stocks-timespreads curve and backwardation in H2.
- **Still selectively bullish.** The comparison of market pricing and fair value of timespreads based on current coverage ratios leads us to reiterate our selectively bullish views.
  - The estimate that current copper 1/12 month timespreads look about 2 standard deviations (~$650/ton) too low vs. fair value and the non-linear copper curve **support our bullish copper call** that the copper price will jump 65% by 2025.
  - The estimate that Brent timespreads have slightly overshot fair value supports the forecast that **crude oil prices are likely to consolidate in coming months** (although the risks to our crude oil price forecast skew moderately to the upside)
  - By reducing the cost of holding inventories and supporting end demand, **Fed rate cuts should support timespreads**, especially for cyclical refined oil products and industrial metals.

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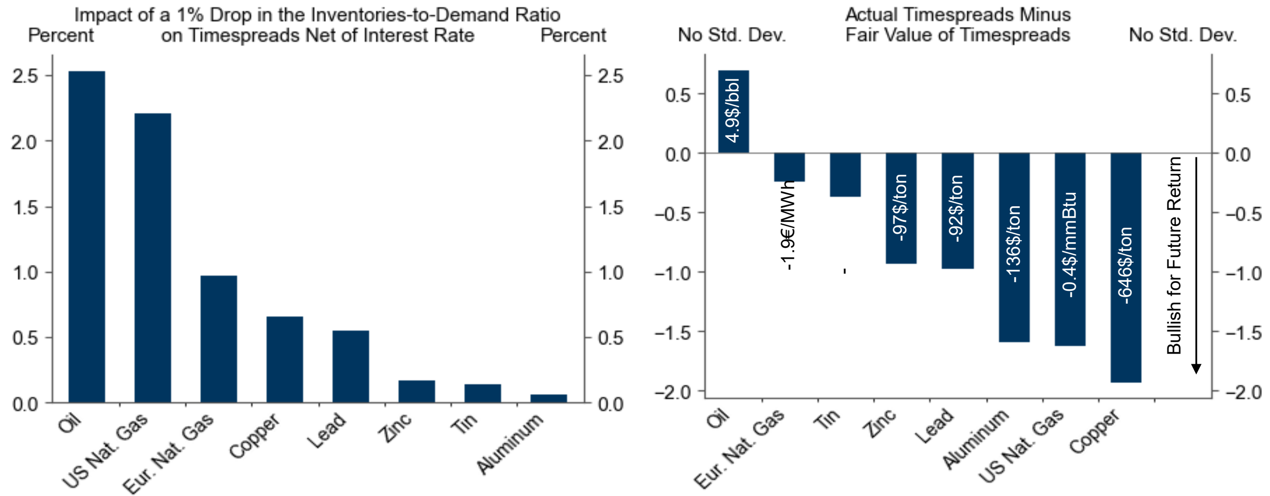
Inventories Matter the Most for Energy Prices; Actual Copper Timespreads Screen 2 Standard Deviations (~$650/ton) Too Low vs. Fair Value



We consider the 1-mont to 13-month timespreads for oil and gas, and the 1-month to 12-month timespreads for metals due to data availability. In the right panel, the bars represent the difference between realized timespreads and their fair value estimate based on inventory coverage ratios (where the difference is expressed in standard deviations). Fair values are based on latest available inventories data: February 29, 2024 for the metals and March 31, 2024 for oil and both European and US natural gas, while actual timespreads are as of April 3, 2024.

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Timespreads Don't Lie; Copper Backwardation is Coming

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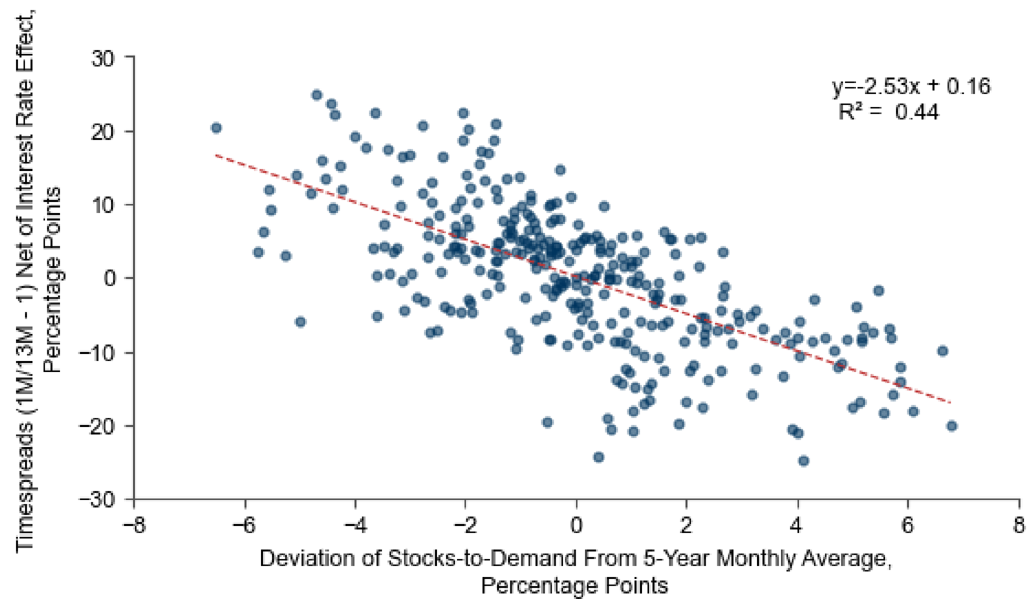
We have long argued that timespreads—spot prices versus forward prices—do not lie about the physical tightness of the oil market. Empirically, the negative relationship between timespreads (net of interest) and stocks is quite strong, where a 10% decline in OECD commercial oil stocks as a share of demand boosts 1-month to 13-month Brent timespreads by about 25%, or $20/bbl when the back-end is about $80/bbl (Exhibit 1). As Exhibit 2 shows, this framework has continued to explain the ups and downs in oil timespreads reasonably well in recent years.

In this piece, we extend our inventories-timespreads framework to 7 other commodities than oil, building further on our recent tracking of inventory tightness.

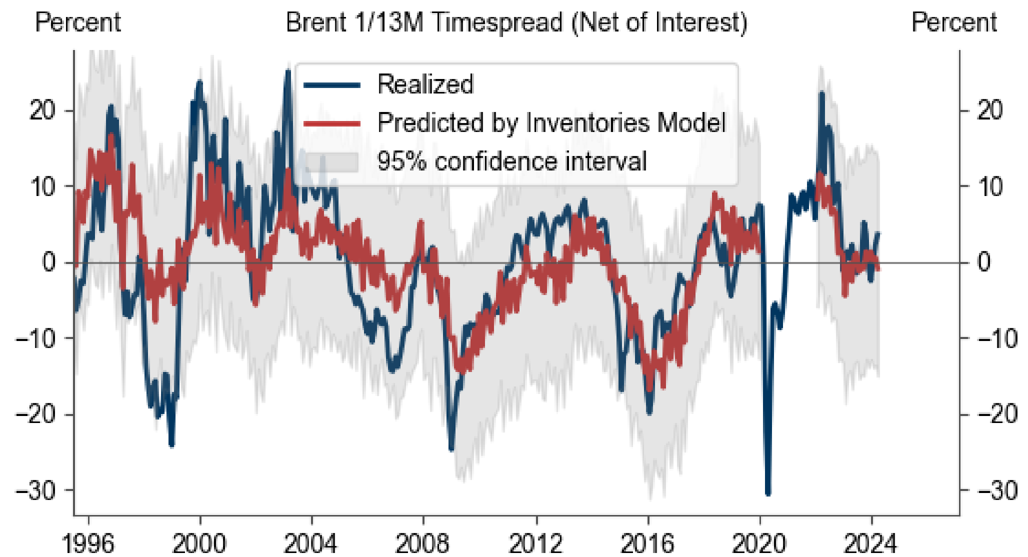
Exhibit 1: A Close Link Between Timespreads and Oil Inventory Levels



We adjust the inventories-to-demand ratio for seasonal and structural shifts by subtracting the 5-year month-specific average, excluding 2020 and 2021. We consider the Brent 1-month to 13-month timespreads net of interest rate effect, and exclude 2020 and 2021 from our analysis.

Source: IEA, Goldman Sachs Global Investment Research

Exhibit 2: The Inventories-Based Model Captures the Ups and Downs in Oil Timespreads



We consider the Brent 1-month to 13-month timespreads net of interest rate effect. We exclude 2020 and 2021 from our analysis.

Source: IEA, CME, Company data, Goldman Sachs Global Investment Research

Timespreads Usually Don't Lie, Especially for Energy

We find a negative and statistically significant impact of inventory coverage ratios[1] on timespreads across the eight commodities we study (Exhibit 3), with larger effects for energy than for metals.[2]

Low inventories boost timespreads the most for oil and natural gas, because energy is very price inelastic in the short-run.[3] In contrast, metal inventories have a smaller impact on timespreads, likely because even though short-run supply is inelastic, it remains so in the medium-run due to the lengthy process of mining, often spanning a decade. Additionally, short-run demand for metals is less inelastic compared to energy because, while oil and gas shortages can halt economic activity immediately, the need for metals in construction projects or final goods can typically be delayed for a short time if necessary (the appendix provides cross-commodity predictions). The greater impact of stocks on timespreads for natural gas than for metals (Exhibit 3 shows the sample average across all months) likely also reflects a larger sensitivity and larger convenience yields for natural gas in the winter months.

[1] Our coverage ratio is constructed as follows. First, we gather data on inventories and demand across the commodities. We include OECD commercial oil stocks and product stocks. For US natural gas, we include lower 48 states total natural gas in underground storage reported by the EIA. For European natural gas, we include inventories from GIE. For metals, we include global stocks from metal exchanges LME and SHFE, as well as COMEX for copper and aluminum. Second, we divide reported inventories in a given month by reported demand in the same month, and use our demand forecasts if inventories data are more timely. Third, we adjust for seasonal and structural shifts in the inventory-to-sales ratio by subtracting the 5-year month-specific average, excluding 2020 and 2021.

[2] We exclude 2020 and 2021 from our analysis across all commodities studied. Our samples start in 1991 for oil, 1995 for the metals, 2001 for US natural gas, and 2015 for European natural gas.

[3] The lower sensitivity of natural gas spreads to shocks in Europe relative to the US may reflect that coverage ratios are on average higher in Europe.

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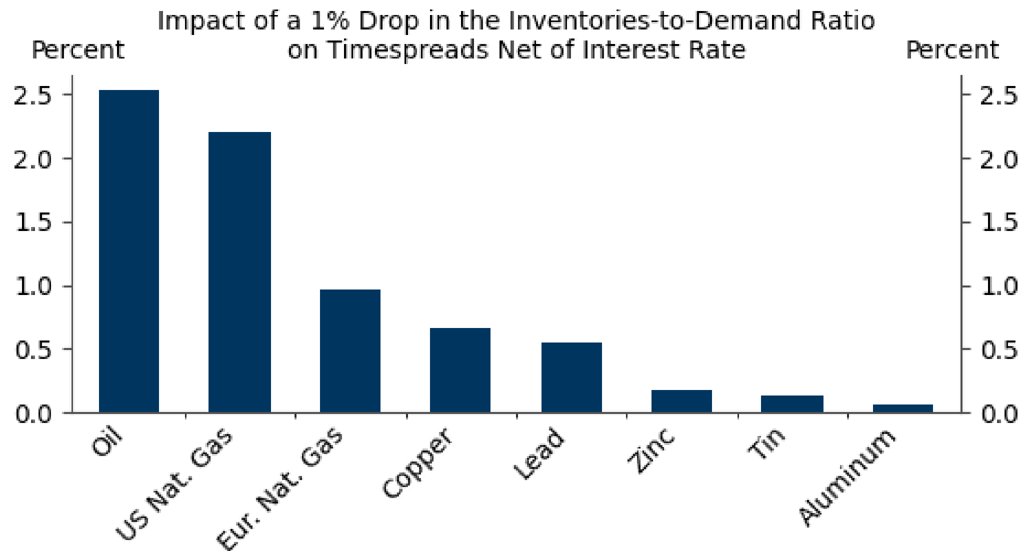
Exhibit 3: Low Inventories Boost Timespreads the Most for Oil and Natural Gas



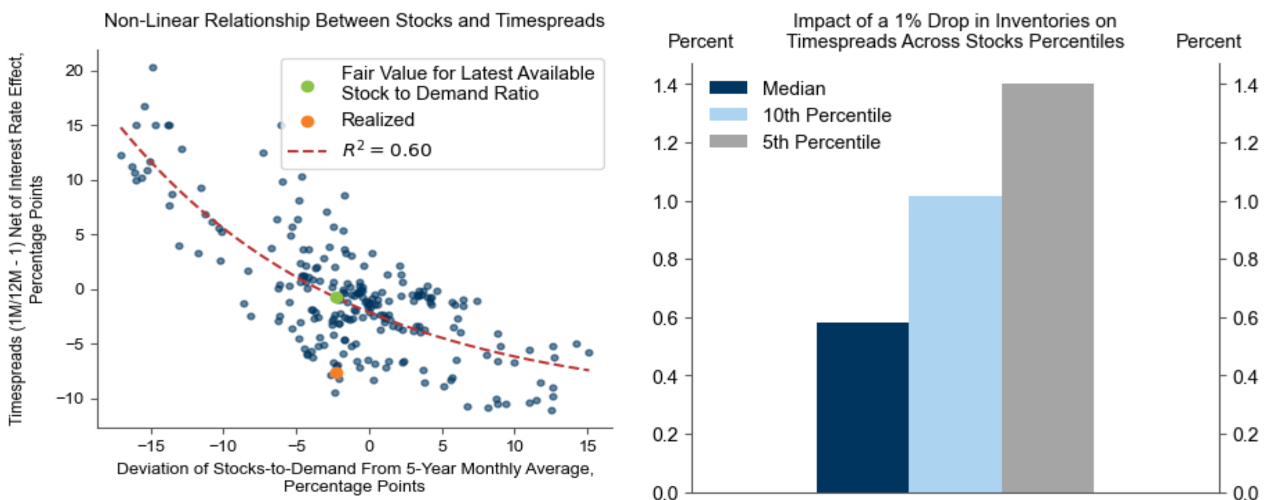
The inventories-to-demand ratio is adjusted for seasonal and structural shifts by subtracting the 5-year month-specific average, excluding 2020 and 2021. We consider the 1-month to 13-month timespreads for oil and gas, and the 1-month to 12-month timespreads for metals due to data availability.

Source: IEA, WBMS, EIA, Goldman Sachs Global Investment Research

Approaching Steeper Part of the Curve and Copper Backwardation

We find that the relationship between inventories and timespreads is highly non-linear for industrial metals, such as copper, aluminum, and lead. The boost to timespreads from a drop in copper stocks tends to be modest when stocks are within historical norms, but rises sharply when dropping to depletion level lows (Exhibit 4).

Exhibit 4: The Boost to Timespreads Rises Exponentially as Copper Inventories Approach Depletion



The inventories-to-demand ratio is adjusted for seasonal and structural shifts by subtracting the 5-year month-specific average, excluding 2020 and 2021. Copper inventories include global stocks from metal exchanges LME, COMEX and SHFE, and latest available stock to demand ratio is as of February 29, 2024. Timespreads are net of interest rate effect, and latest realized is as of April 3, 2024.

Source: WBMS, LME, Goldman Sachs Global Investment Research

While copper is now already the tightest commodity we analyze, our metals team expects that large deficits from Q2 will push the market into the steep scarcity pricing part of the curve and into backwardation in H2.

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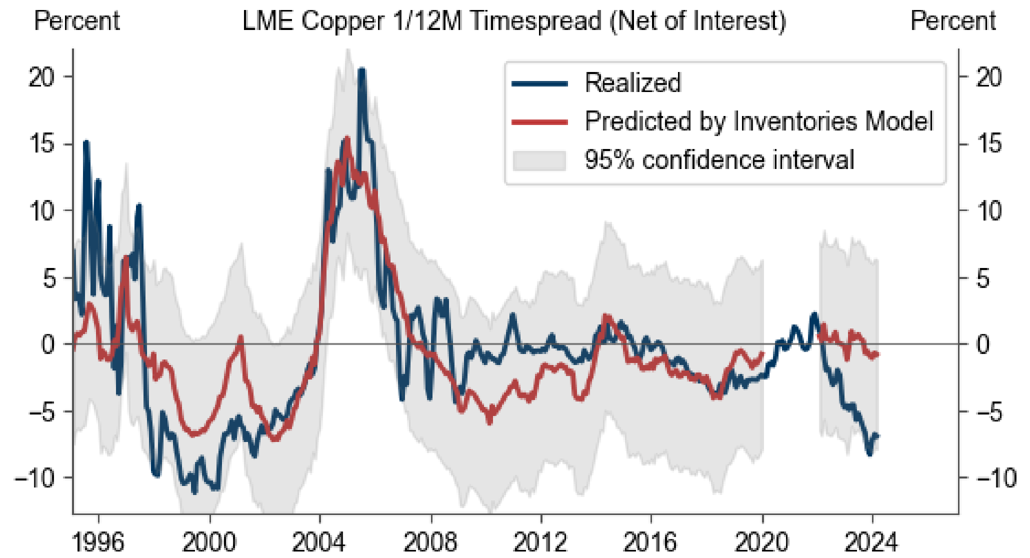
When accounting for copper's non-linear relationship, our framework explains the fluctuations in timespreads reasonably well (Exhibit 2).

Exhibit 5: Copper Timespreads Now Look Very Low Compared to Fair Value



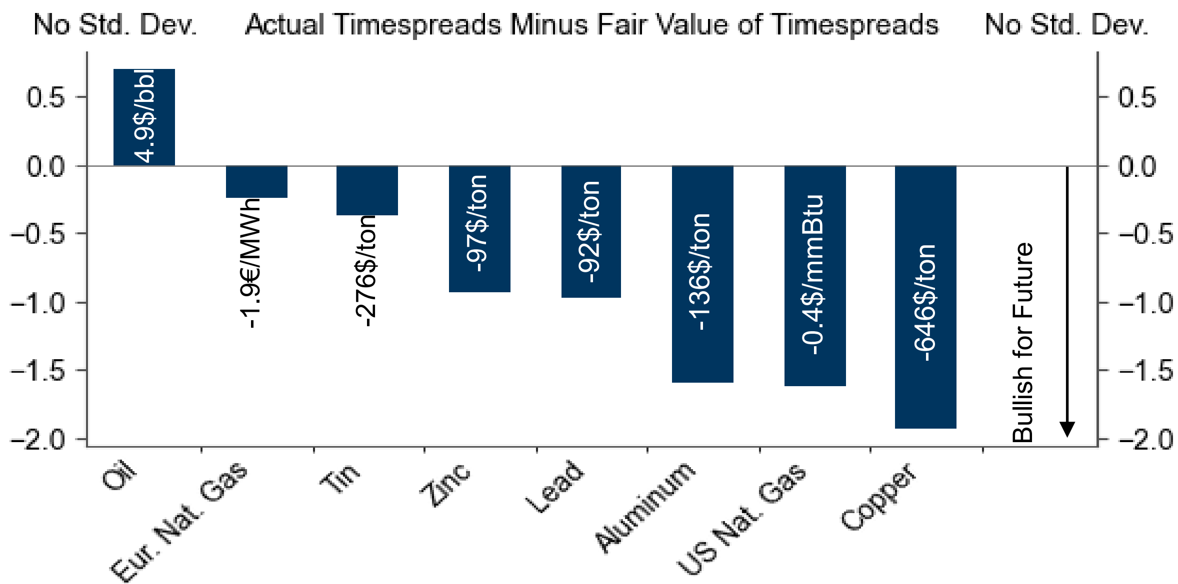
We consider the LME copper 1-month to 12-month timespreads net of interest rate effect, and exclude 2020 and 2021 from our analysis.

Source: WBMS, LME, Goldman Sachs Global Investment Research

Still Selectively Bullish

The comparison of market pricing and fair value of timespreads based on current inventory coverage ratios leads us to reiterate our selectively bullish views (Exhibit 6):

Exhibit 6: Copper Timespreads Are Below Fair Value, While Brent Timespreads Have Slightly Overshot



For Brent, European natural gas and Us natural gas, we use 1-month to 13-month timespreads; for the metals, 1-month to 12-month timespreads. The bars represent the standard deviations from fair value in realized timespreads. Fair values are based on latest available inventories data: February 29, 2024 for the metals and March 31, 2024 for oil and both European and US natural gas, while actual timespreads are as of April 3, 2024.

Source: ICE, LME, WBMS, IEA, Goldman Sachs Global Investment Research

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First, current copper 1/12m timespreads look about two standard deviations (~$650/ton) too low versus fair value and the non-linearity in the copper inventories-timespreads curve supports our bullish copper call that the copper price will jump 65% by 2025. The comparable gap between current and predicted aluminum timespreads, however, merits caution, due to a lower model fit.

Second, while we see the risks to our crude oil price forecast as skewed moderately to the upside, we estimate that Brent timespreads have slightly overshot fair value, which supports our forecast that crude oil prices are likely to consolidate in coming months.

Third, we also expect additional support to timespreads from Fed rate cuts, by reducing the cost of holding inventories and supporting end demand, especially for cyclical refined oil products and industrial metals.

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Appendix: Cross-Commodity Predictions on the Impact of Inventories on Timespreads

This appendix asks 1) why do timespreads generally not lie about spot fundamentals? and 2) for which commodities should the impact be the largest.

Why timespreads don't lie?

The key reason is that arbitrage opportunities between spot and futures markets discipline timespreads and keep them in line with the cost of storage.

To see the relationship between timespreads and stocks more formally, imagine an investor who buys a commodity at spot price S financed at an interest rate r. The spot price S should match the net marginal convenience yield C, which is the benefit from having the commodity on hand (like smoothing production and avoiding stock outs), minus any storage and insurance costs k. It should also take into account the resale value of the commodity at the futures price F after deducting the cost of financing rS:

$$S = C(stocks) - k + F - rS$$

$$S - F = C(stocks) - k - rS$$

Thus, timespreads - spot minus future price - equal the convenience yield, which rises sharply when stocks are low, net of the costs of storage, insurance and interest. In our framework, we consider timespreads net of interest, because accounting for rates strengthens the impact of stocks and improves the explanatory power of our model.

For which commodities should we expect the biggest boost from low stocks to timespreads?

By definition, timespreads react more sharply to spot stocks, when current stocks significantly affect the spot price yet have less impact on future prices (Exhibit 7). We thus expect timespreads to respond the most to stocks when:

- demand and supply are very inelastic in the short run (e.g. oil and gas), causing spot prices to rise sharply as buyers are willing to pay any price to secure whatever is available and supply struggles to ramp up quickly.
- demand and supply are elastic in the medium run, limiting the impact on future prices

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Exhibit 7: The Elasticity of Demand and Supply Drive the Sensitivity of Timespreads to Stocks

Factors Making Timespreads (S - F) More Sensitive to Stocks	Price Mechanism When Stocks Drop	High for ...
1. Inelastic demand in short-Run	Spot price S increases as buyers compete for available stock	Oil & gas (essential for immediate use and limited substitutes in short-run)
2. Inelastic supply in short-Run	Spot price S increases because producers cannot ramp up production quickly to meet demand	All commodities
3. Elastic demand in medium-run	Limited boost to futures price F as demand adjusts (e.g. switching to substitutes)	Agricultural commodities such as wheat and corn (consumers can switch to alternative grains)
4. Elastic supply in medium-run	Limited boost to futures price F as production increases	Short-cycle oil (low for metals due to decade-long mining)

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