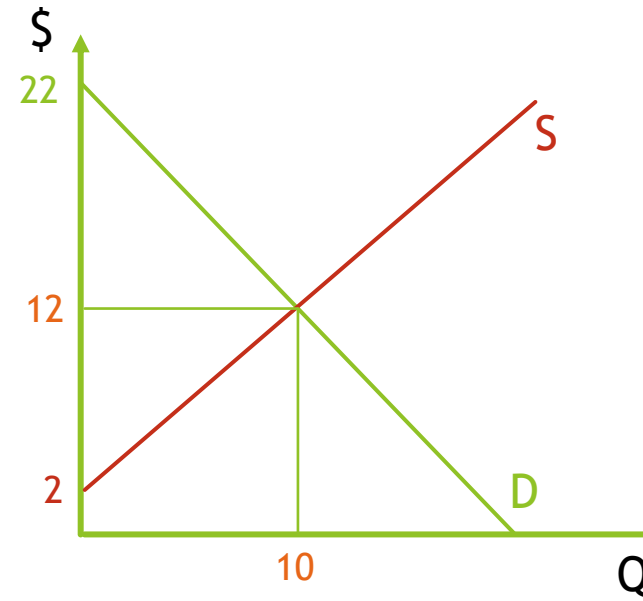


# Problem (1): market equilibrium

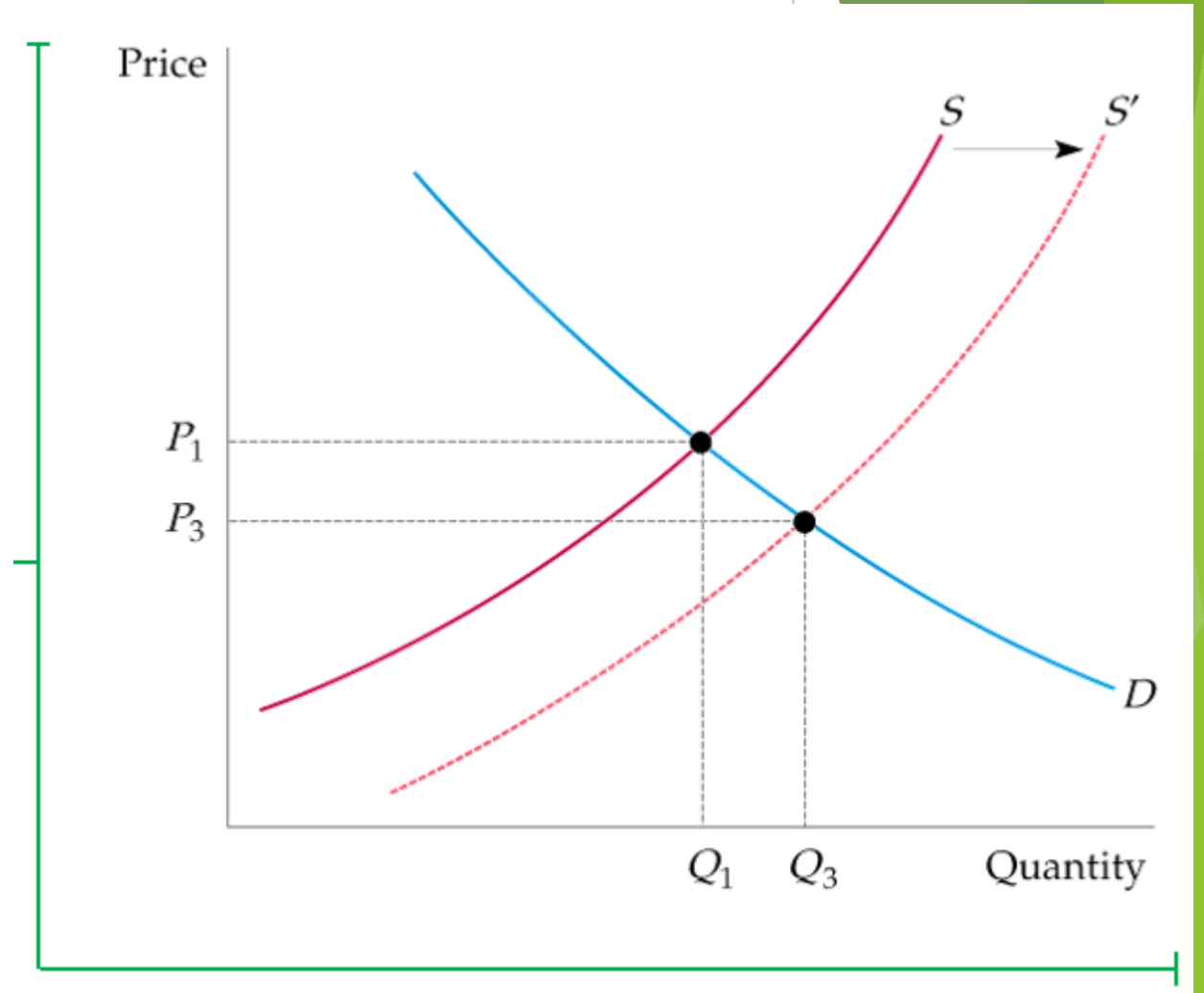
- ▶ Eq. describing the Supply of copper
  - ▶  $P_S = 2 + Q_S$
- ▶ Eq. describing the Demand of copper
  - ▶  $P_D = 22 - Q_D$
- ▶ Find the equilibrium price and quantity of copper
  - ▶  $P^* = 12$
  - ▶  $Q^* = 10$



# 3. Changes in Market Equilibrium

- ▶ When there is
  - ▶ a technological improvement,
  - ▶ a reduction in the wage rate or in the price of the factors of production used for timber extraction
- ▶ the supply function shifts to the right
- ▶ and the market will reach a new equilibrium at  $P_3$ ;  $Q_3$ .

$P \downarrow$     $Q \uparrow$

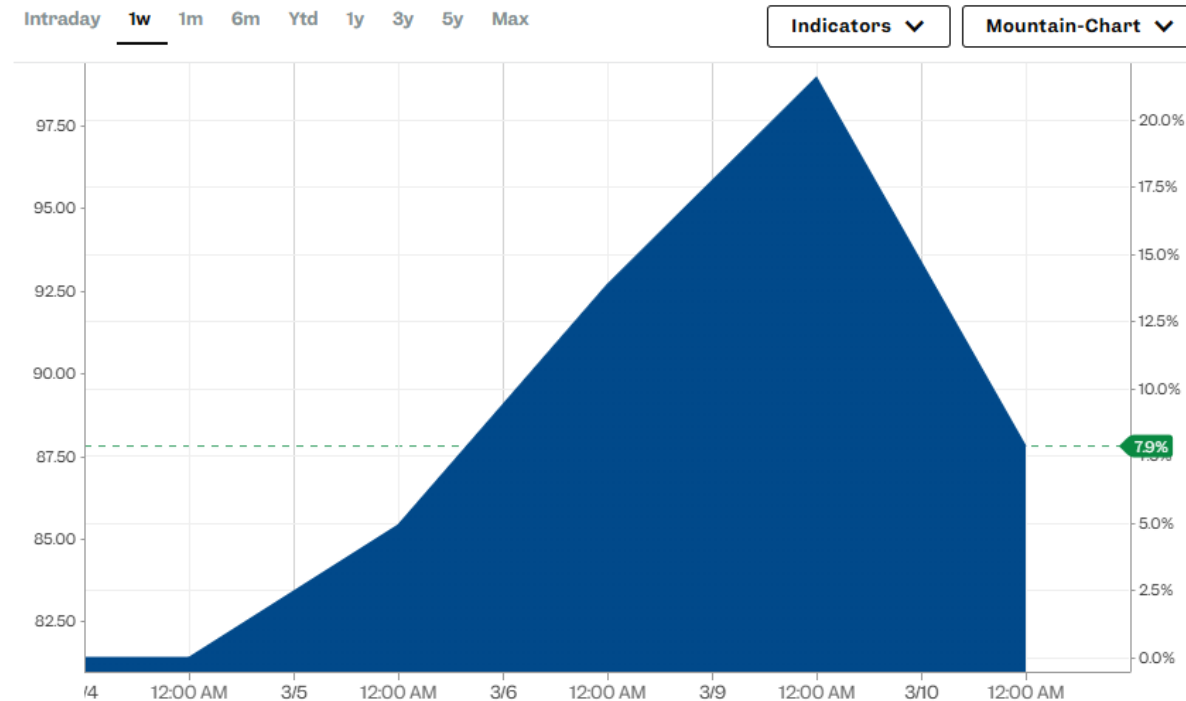


# The Oil market: supply

**OIL (BRENT)** Price Add to watchlist

**86.93** -0.87 (-0.99%)

01:00:00 AM MI Indication

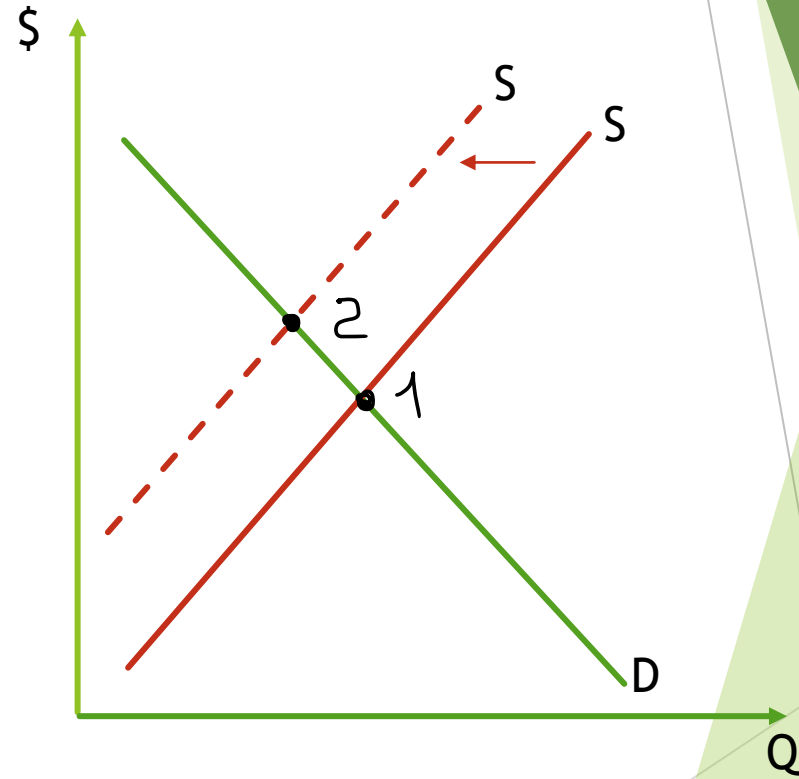


<https://markets.businessinsider.com/commodities/oil-price>

# The Oil market: supply

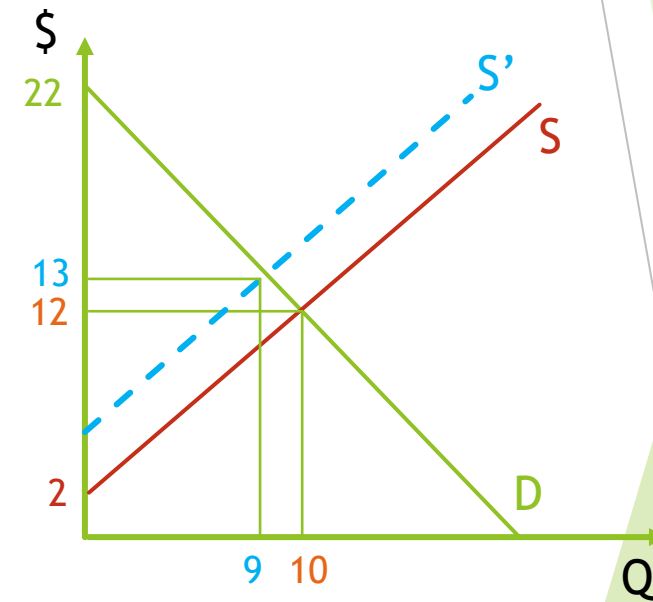
- ▶ **Geopolitical Conflict in Iran:**
  - ▶ Attacks on vessels and threats to navigation in the Strait of Hormuz, a critical maritime oil route, have nearly halted shipping in the region
- ▶ **Massive Supply Disruption:**
  - ▶ up to 20% of global oil supply threatened
- ▶ **Production Shut-ins:**
  - ▶ UAE, Kuwait, and Iraq have been forced to cut production because available tankers are fully loaded and storage capacities are at their limits

P  Q 



# Problem (2): Supply shift

- ▶ Eq. describing the INITIAL Supply of copper
  - ▶  $P_S = 2 + Q_S$
- ▶ Eq. describing the Demand of copper
  - ▶  $P_D = 22 - Q_D$
- ▶ Assume there is an increase in the cost of copper extraction, so the Eq. of the FINAL Supply of copper is
  - ▶  $P_S = 4 + Q_S$
- ▶ Find the NEW equilibrium price and quantity of copper
  - ▶  $P^* = 13$
  - ▶  $Q^* = 9$
- ▶ Find the % change of the equilibrium price and quantity
  - ▶  $\Delta P = (13-12)/12 = +8.3\%$
  - ▶  $\Delta Q = (9-10)/10 = -10\%$



# Changes in Market Equilibrium

- ▶ When there is
  - ▶ an increase of the disposable income,
  - ▶ a change of the preferences of individuals or businesses
  - ▶ an increase of the price of the substitutes
  - ▶ a decrease of the price of complements
- ▶ the demand function shifts to the right
- ▶ and the market will reach a new equilibrium at  $P_3$ ;  $Q_3$ .

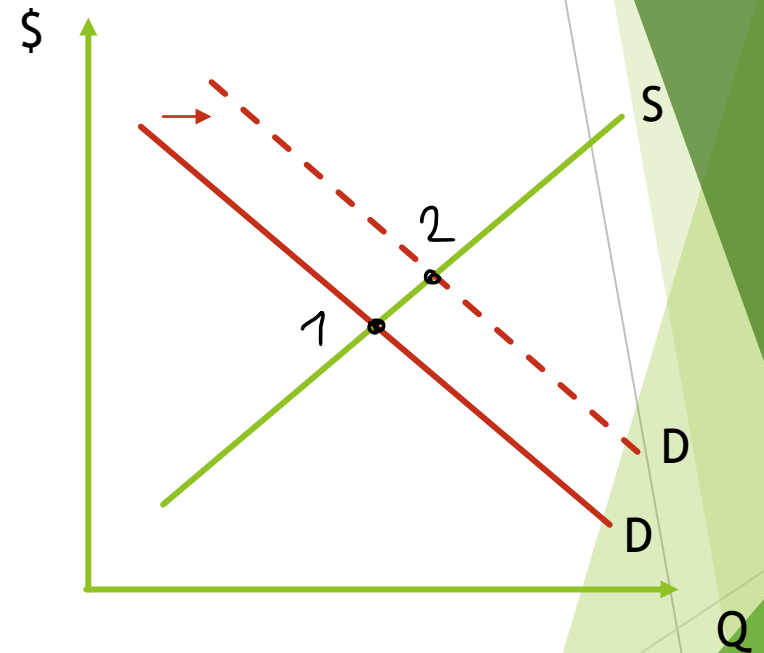
P ↑    Q ↑



# The Copper market: demand

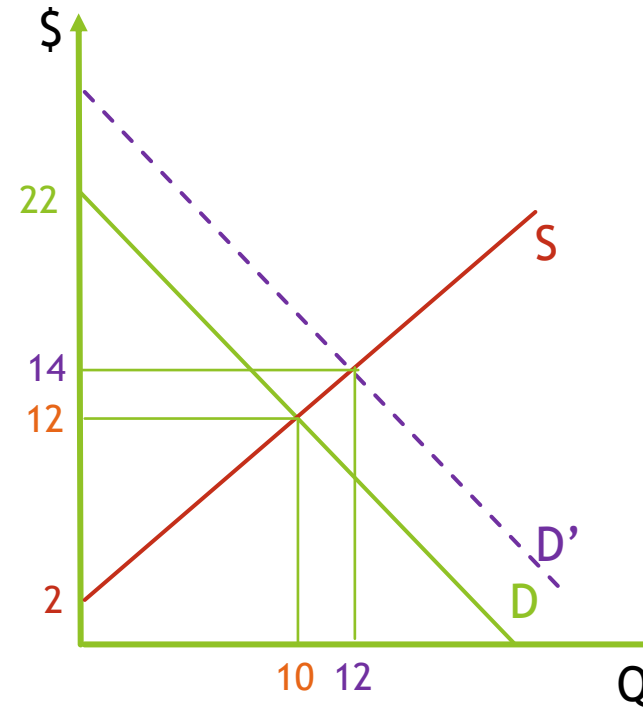
- ▶ **EV Revolution:**
  - ▶ Electric vehicles use substantially more copper for wiring and motors than traditional gasoline-powered cars.
- ▶ **Renewable Energy Expansion:**
  - ▶ The global shift toward electrification requires massive amounts of copper for power grids and renewable energy installations.
- ▶ **Urbanization:**
  - ▶ Ongoing urban development in emerging economies requires significant copper for infrastructure and construction.

P ↑ Q ↑



# Problem (3): Demand shift

- ▶ Eq. describing the Supply of copper
  - ▶  $P_S = 2 + Q_S$
- ▶ Eq. describing the INITIAL Demand of copper
  - ▶  $P_D = 22 - Q_D$
- ▶ Assume that consumers switch from internal combustion to electric vehicles, and more batteries made with copper are needed, so the FINAL Demand of copper is
  - ▶  $P_D = 26 - Q_D$
- ▶ Find the NEW equilibrium price and quantity of copper
  - ▶  $P^* = 14$
  - ▶  $Q^* = 12$
- ▶ Find the % change of the equilibrium price and quantity
  - ▶  $\Delta P = (14-12)/12 = +16.6\%$
  - ▶  $\Delta Q = (12-10)/10 = +20\%$



# The Copper market: demand...and supply

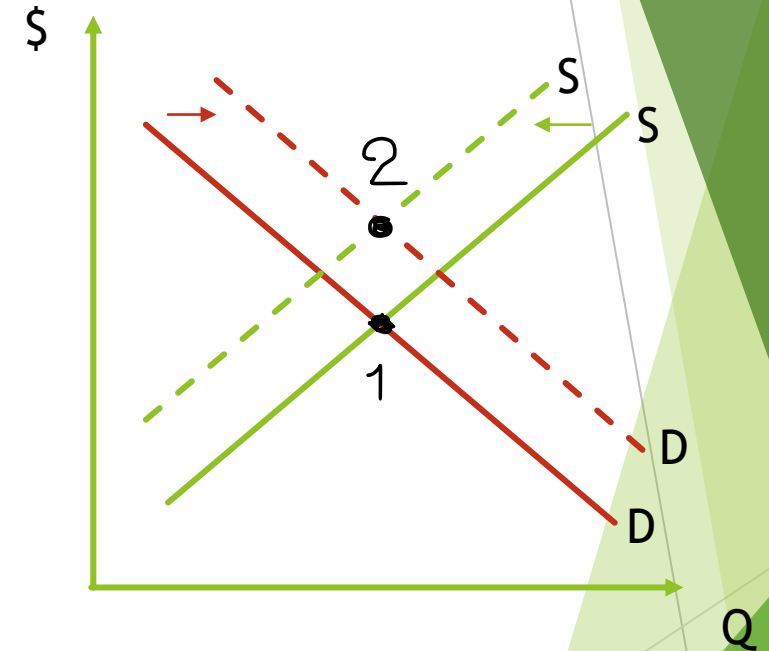
## ► Significant Shutdown:

- The Panamanian government ordered the closure of the Cobre Panama mine, which produced over 350,000 tonnes annually, accounting for roughly 2% of global supply.

## ► Operational Issues:

- Major mining firms, including Anglo-American, announced reduced 2024 production guidance due to declining ore grades and logistical constraints at major mines.

P ↑    Q ?



# Problem (4): Supply and Demand shift

- ▶ Assume both the Supply and the Demand shift,
  - ▶ there is a contraction of the Supply  $P_S = 4 + Q_S$
  - ▶ and an expansion of the Demand  $P_D = 26 - Q_D$
- ▶ Find the NEW equilibrium price and quantity of copper
  - ▶  $P^* = 15$
  - ▶  $Q^* = 11$
- ▶ Find the % change of the equilibrium price and quantity
  - ▶  $\Delta P = (15-12)/12 = +25\%$     ➡ the sign can be predicted a priori
  - ▶  $\Delta Q = (11-10)/10 = +10\%$     ➡ the sign can NOT be predicted a priori

# 4. Elasticities of Supply and Demand

- ▶ Elasticity
  - ▶ percentage change in one variable resulting from a 1-percent increase in another.
- ▶ Price elasticity of demand
  - ▶ percentage change in quantity demanded of a good resulting from a 1-percent increase in its price.

$$E_p = (\% \Delta Q) / (\% \Delta P)$$

$$E_p = \frac{\Delta Q / Q}{\Delta P / P} = \frac{P \Delta Q}{Q \Delta P}$$

# Copper Demand Elasticity

- ▶ The demand for copper is generally inelastic (price inelastic)
  - ▶ in both the short and long run, meaning price changes have a relatively small effect on the quantity demanded.
- ▶ Studies from 1990 to 2020 show that large price spikes do not immediately lead to a proportional drop in consumption.
- ▶ Substitution Limitations:
  - ▶ While aluminum can substitute for copper in some electrical applications, the technical requirements of high-performance electronics, electric vehicles (EVs), and grid infrastructure often make substitution difficult, keeping demand steady.

# Supply elasticity of natural resources

- ▶ The supply of most natural resources is generally inelastic in the short run due to fixed extraction capacities, limited reserves, and long development times
- ▶ Non-renewable Resources (Oil, Minerals):
  - ▶ Highly inelastic, as increasing output requires finding new, costly, and time-consuming sources.
- ▶ Time Period:
  - ▶ Supply is less elastic in the short run and more elastic in the long run as new production technologies or sites are developed.
- ▶ Agricultural Resources:
  - ▶ Inelastic in the short term due to growing seasons but become more elastic over longer periods.
- ▶ Storage Ability:
  - ▶ Resources that are easily stored (like metals) can have more elastic supply than those that cannot, allowing suppliers to adjust to price changes

# Problem (5): price elasticity.

- ▶ Find the elasticity of the demand for and the supply of copper with reference to the price clearing the INITIAL market.
  - ▶  $P_S = 2 + Q_S$
  - ▶  $P_D = 22 - Q_D$
  - ▶  $P^* = 12$  and  $Q^* = 10$
- ▶ Elasticity of the demand =  $(-1) \cdot (12/10) = -1.2$
- ▶ Elasticity of the supply =  $(+1) \cdot (12/10) = +1.2$