

Cyclical behaviour of oil prices

A simple structural approach

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Cyclical behaviour is the defining characteristic of oil market

Cycles are evident in every aspect of the oil industry

Consumption growth	Faster/slower
Production growth	Faster/slower
Investment	Faster/slower
Workforce	Hiring/firing
Oilfield services	Faster/slower
Inventories	Rising/falling
Refining margins	Higher/lower
Prices	Rising/falling
Calendar spreads	Backwardation/contango

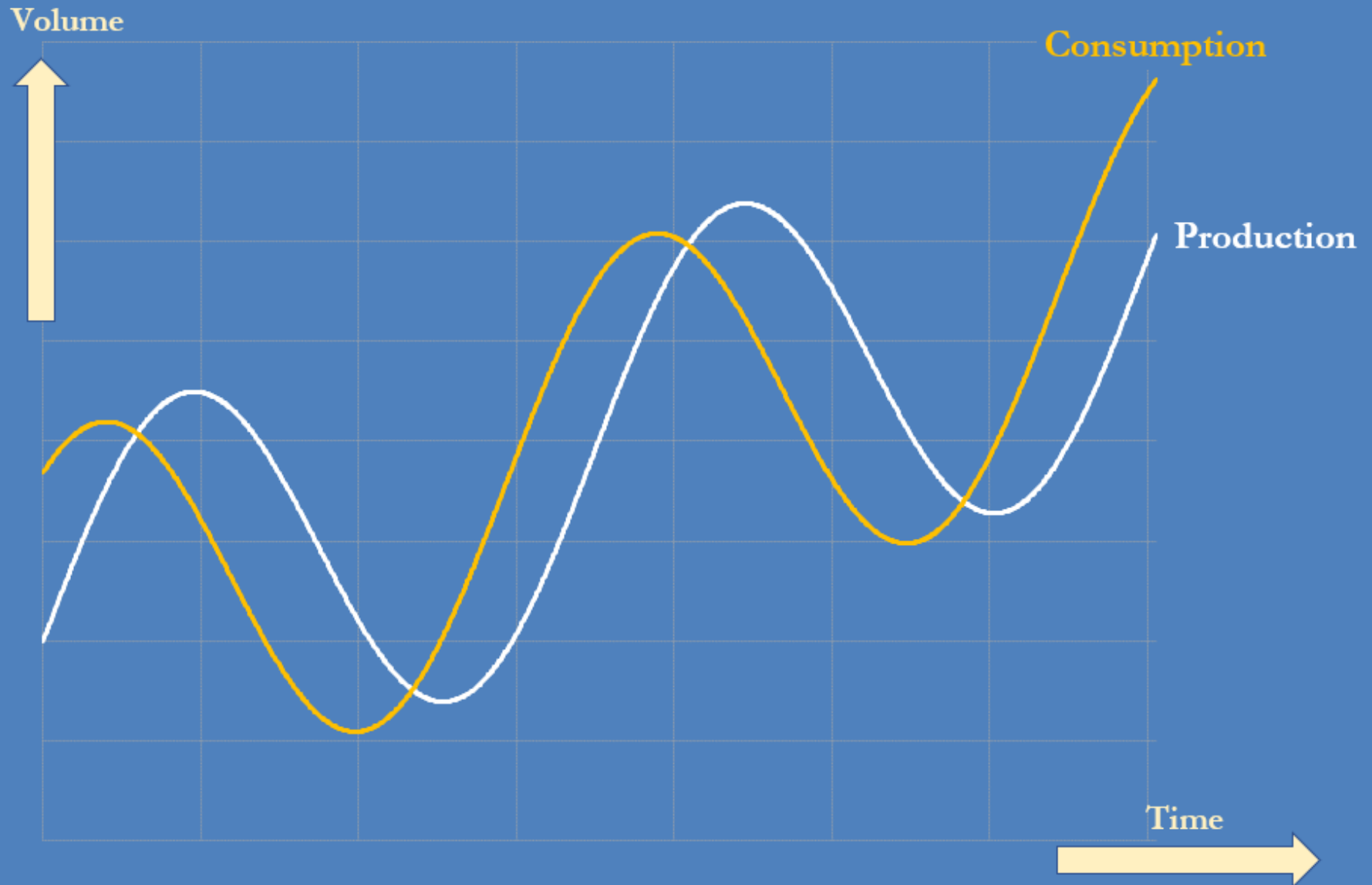
Cycles are irregular

Duration varies

Magnitude varies

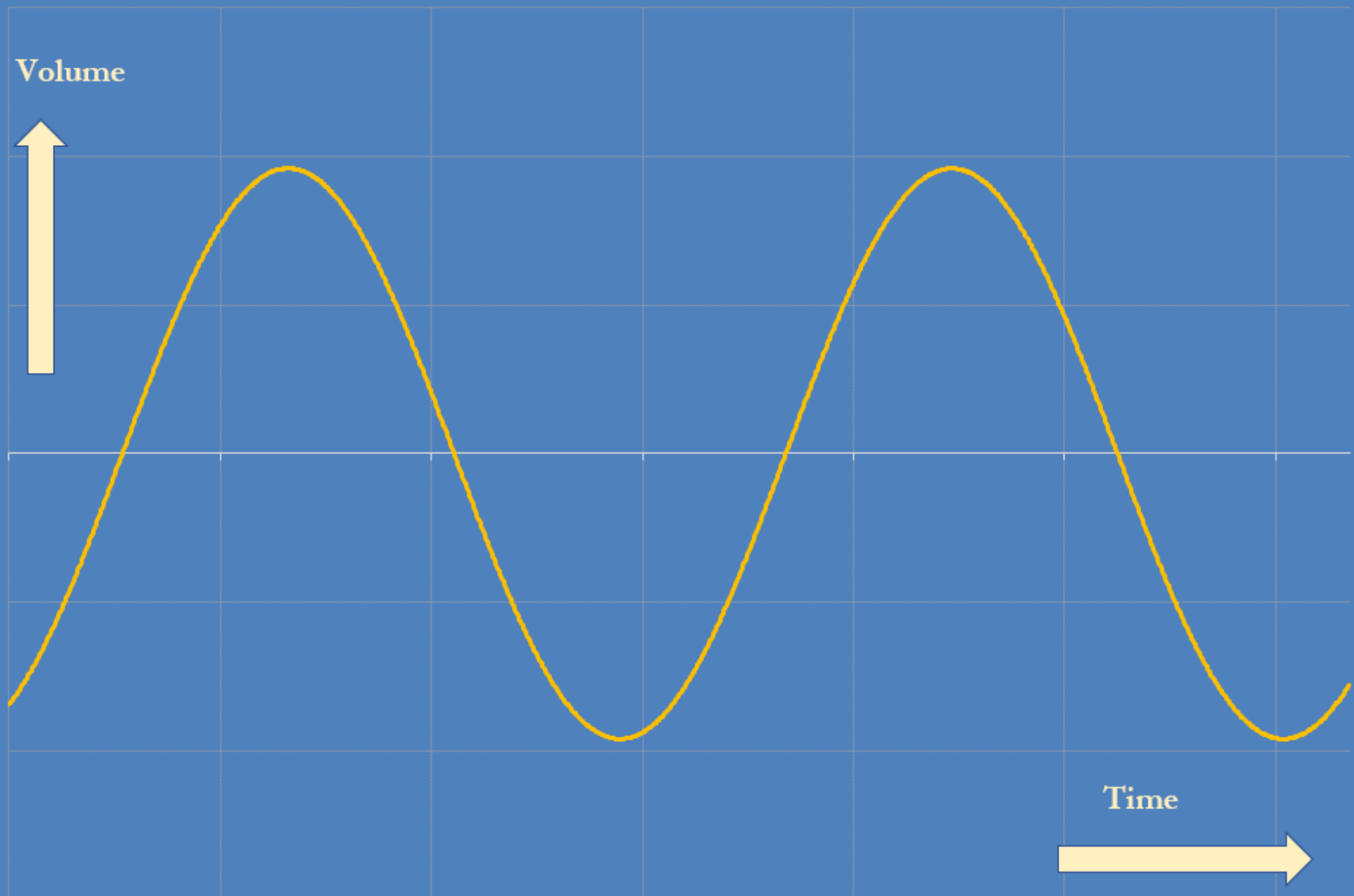
Cycles are not synchronised

Oil production and consumption cycles through time production and consumption cycles out of phase

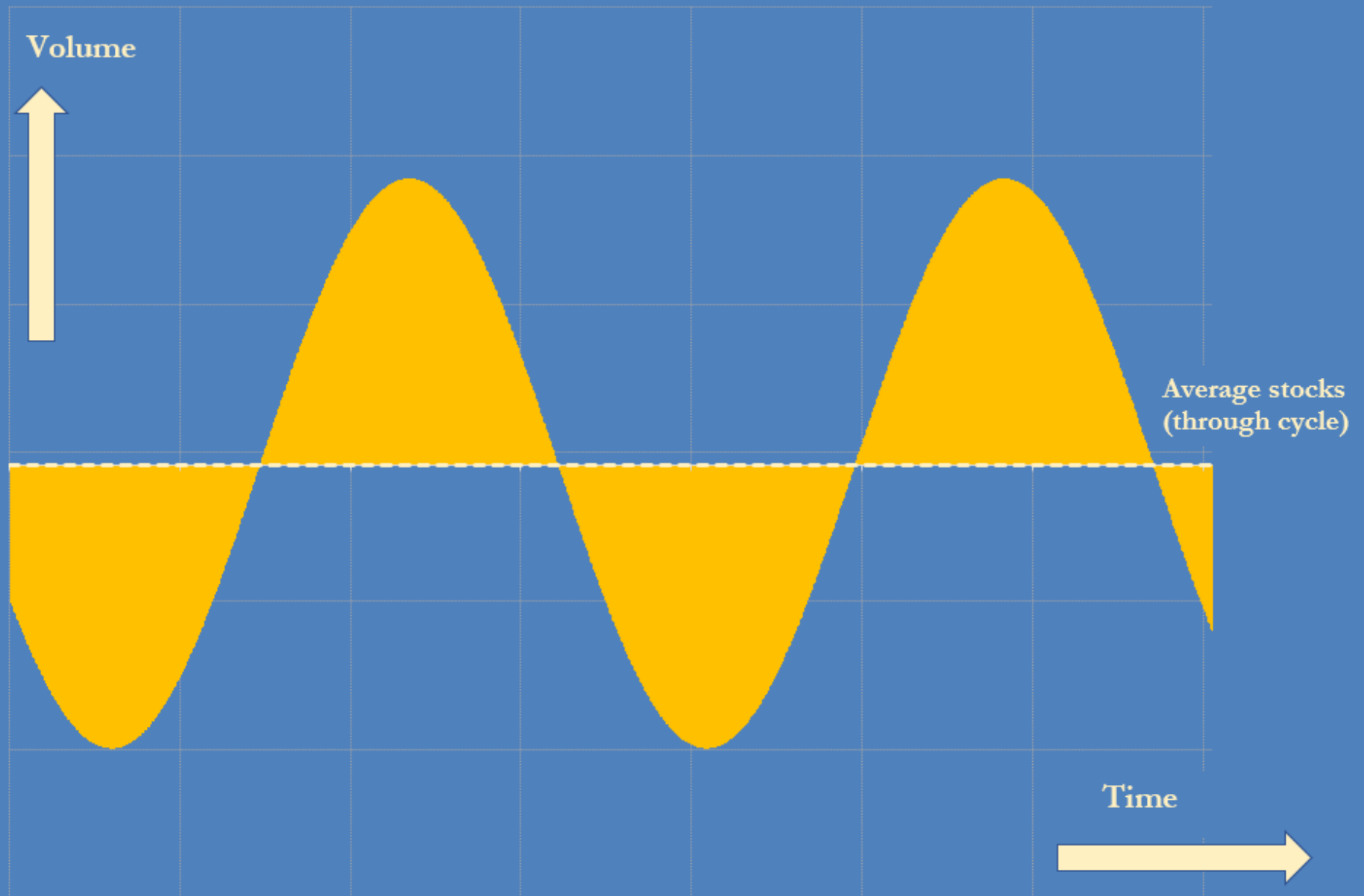


Oil inventories

change from prior period
production-consumption phase differences cause stock changes

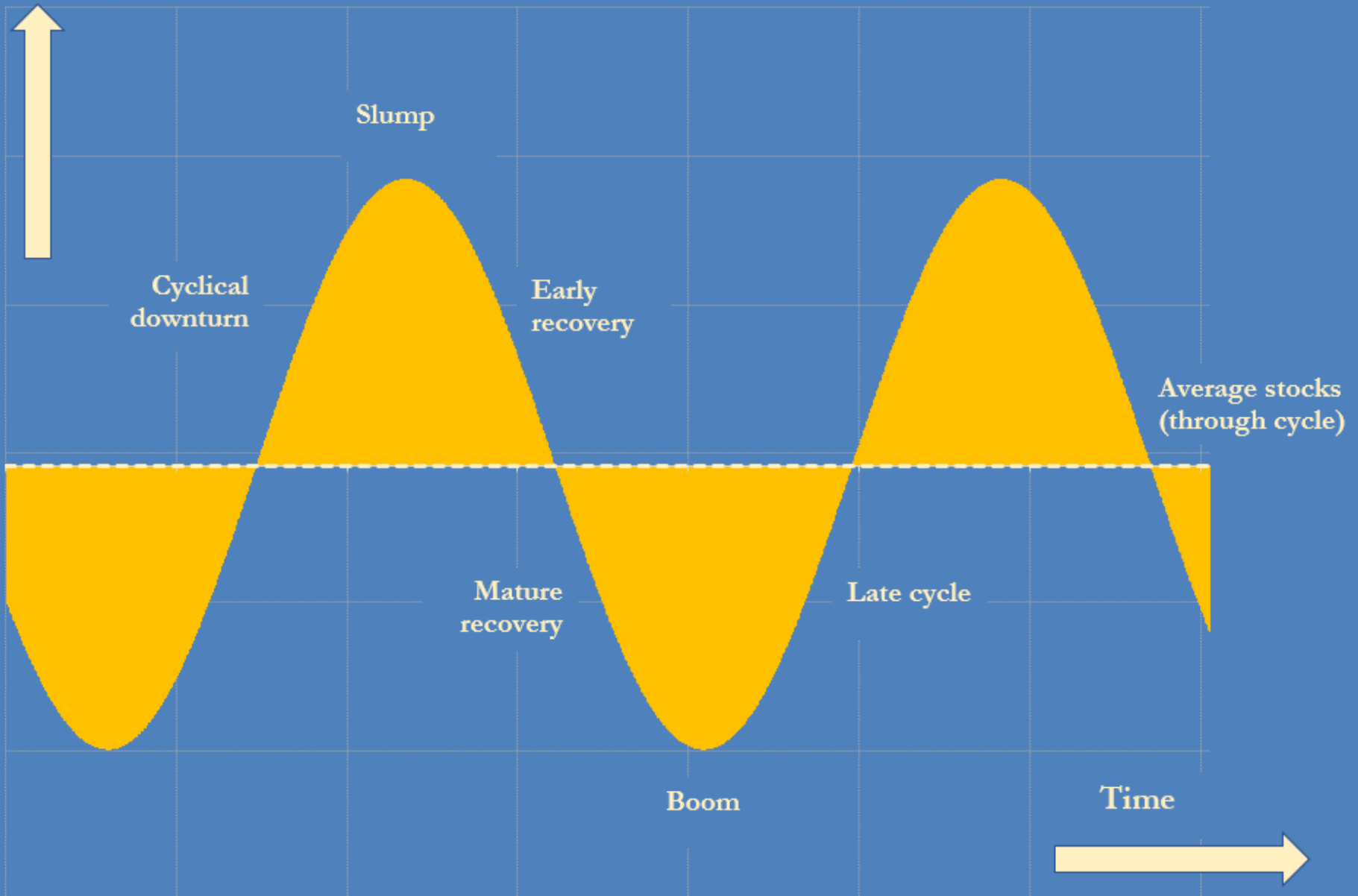


Total oil inventories accumulated sum of prior-period changes



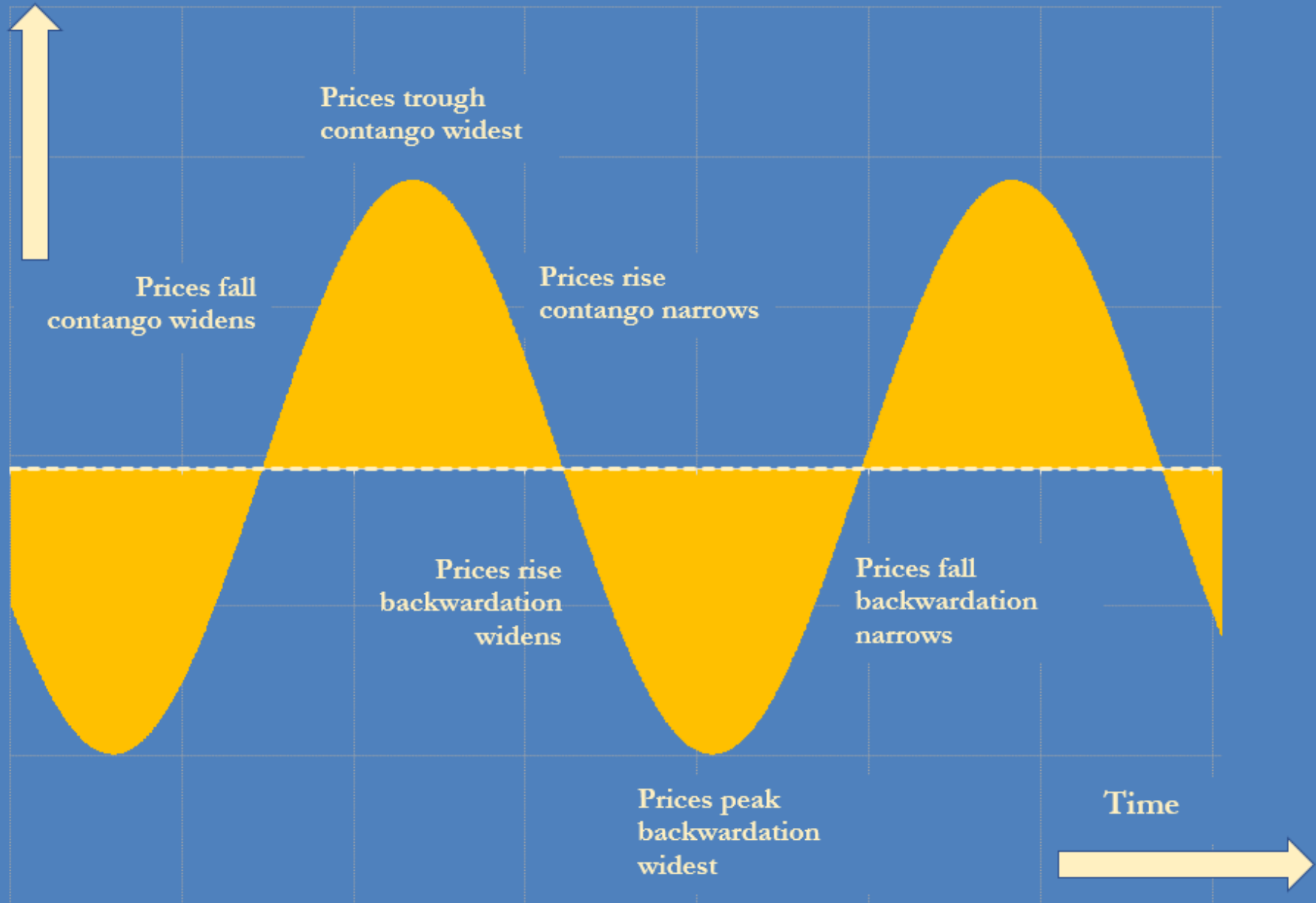
Total oil inventories
accumulated volume
sum of prior-period changes

Volume



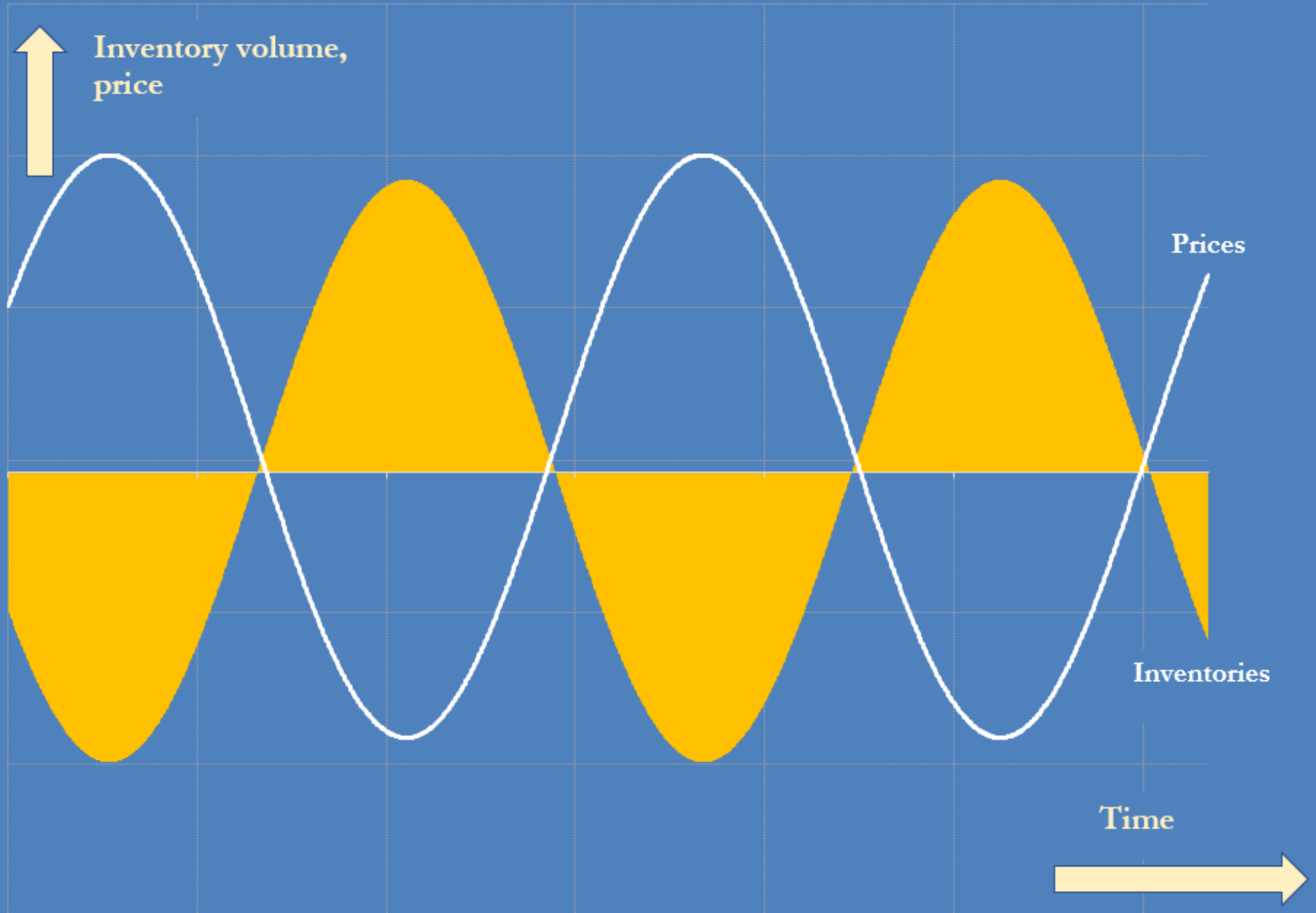
Total oil inventories, prices and calendar spreads accumulated sum of prior-period changes

Volume



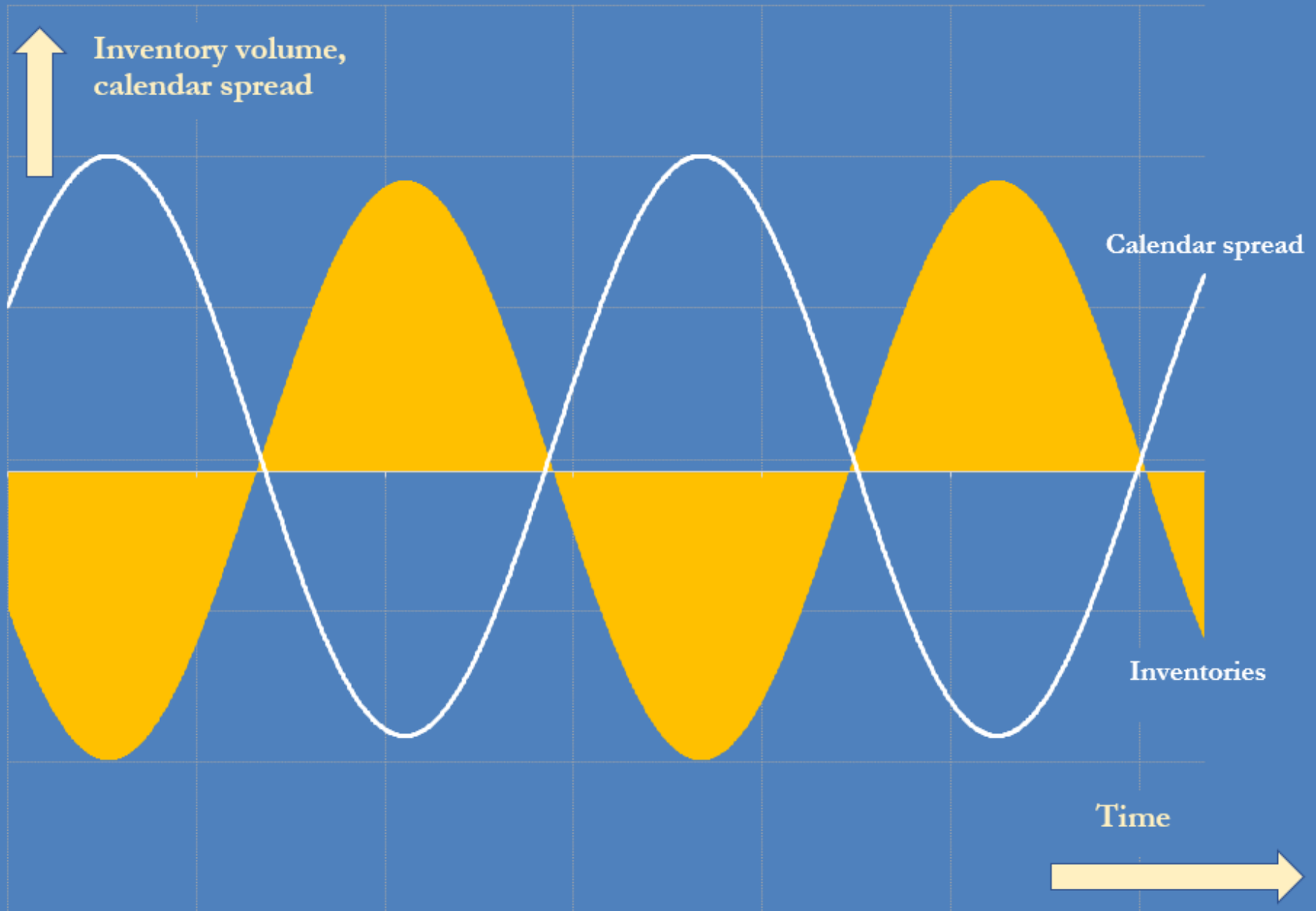
Oil inventories and prices

accumulated volume of inventories and prices

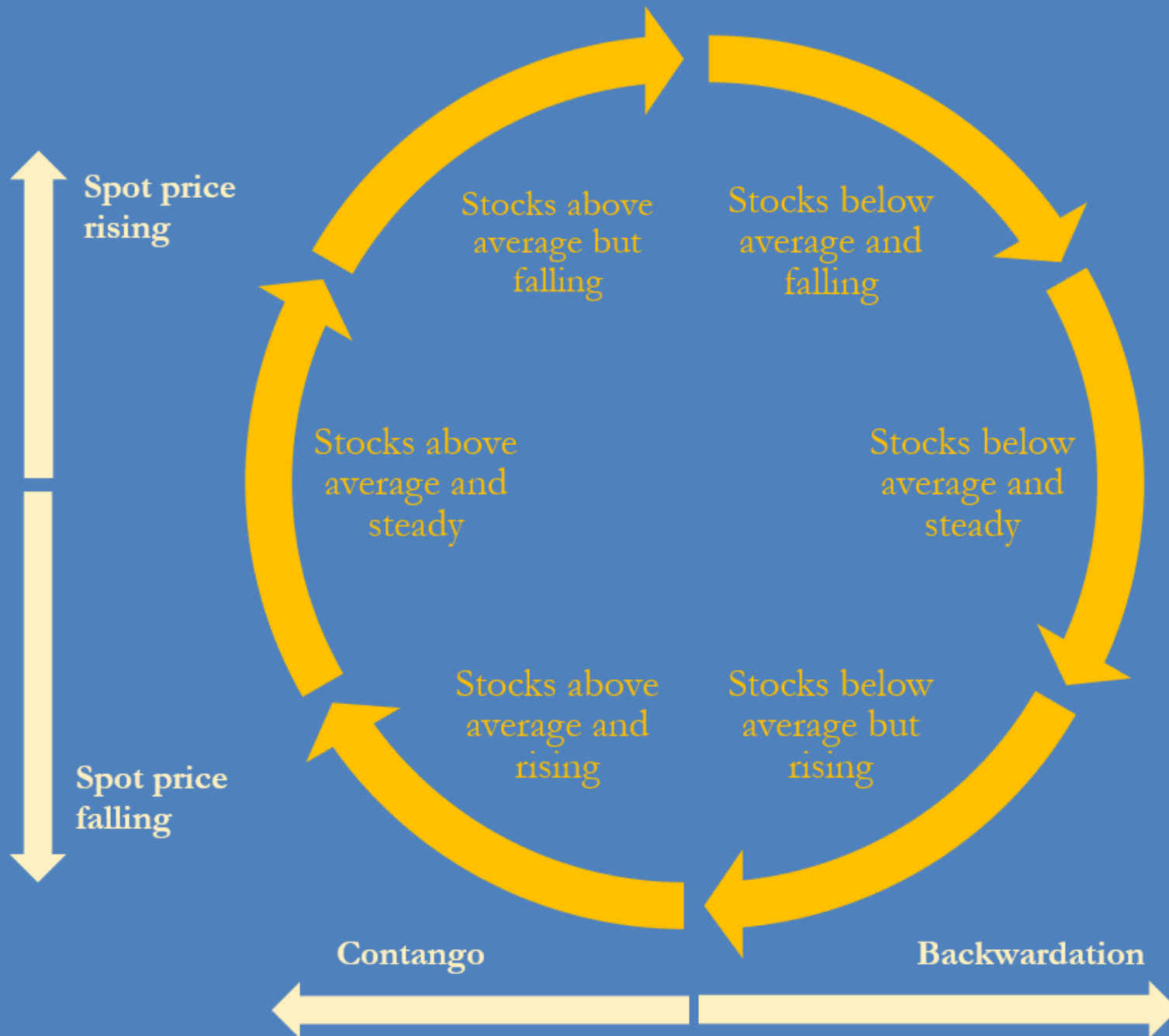


Oil inventories and calendar spreads

accumulated volume of inventories versus calendar spread



Spot prices and calendar spreads in the oil market cycle

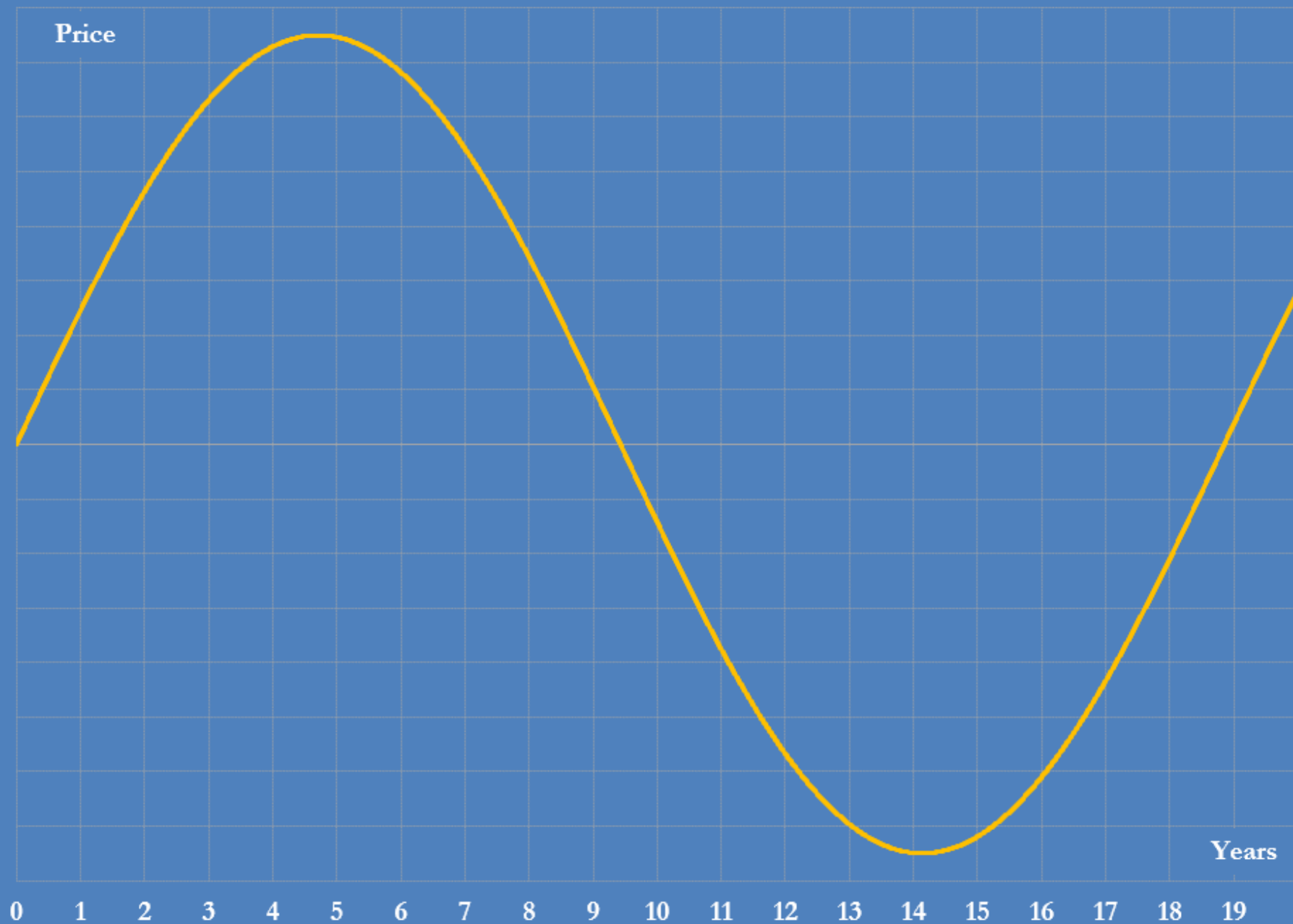


Oil prices exhibit cyclical behaviour at all timescales

Seconds, minutes, hours, days, months, years and multiple years

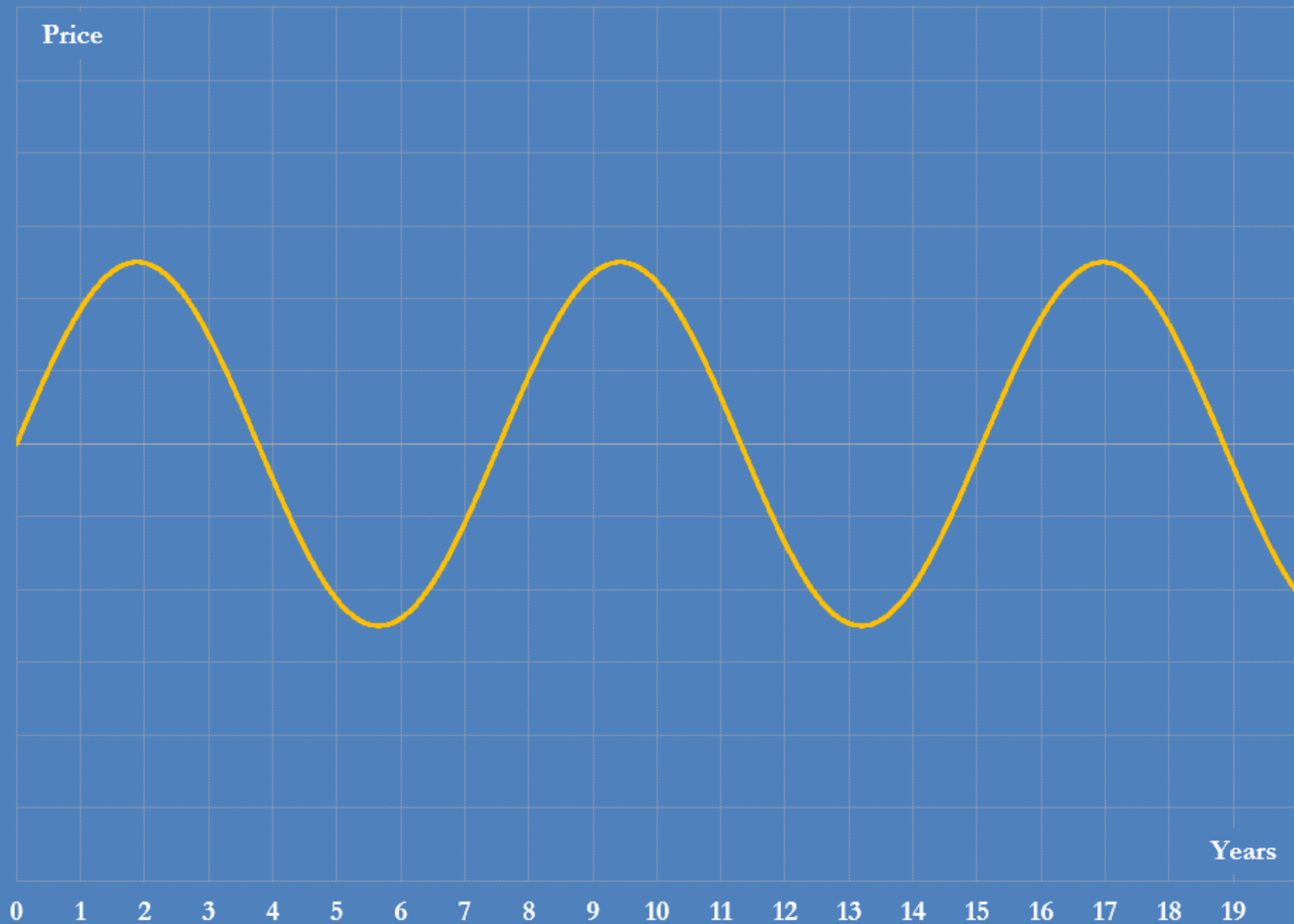
Time horizon	Cycle length	Causes
Very short term	Seconds to weeks	Entry and exit of trading positions Market-making Trend-following
Short term	Days to months	Production outages Extreme weather events Political risk Cross-market correlations
Medium term	Months to a year	Oil market inventory cycle Seasonal consumption variations Unusual heating/cooling demand Mini business cycles
Long term	Multiple years	Oil industry investment cycle Macroeconomic business cycle Fuel conservation/substitution
Very long term	Decade-plus	Secular consumption shocks U.S. industrialisation/urbanisation (late 19th/early 20th centuries) European post-war reconstruction (mid-20th century) China's industrialisation/urbanisation (late 20th/early 21st centuries) Energy system changes Technology changes Price shocks and long-term demand destruction

Oil prices multi-decade supercycles (~ 20 years)



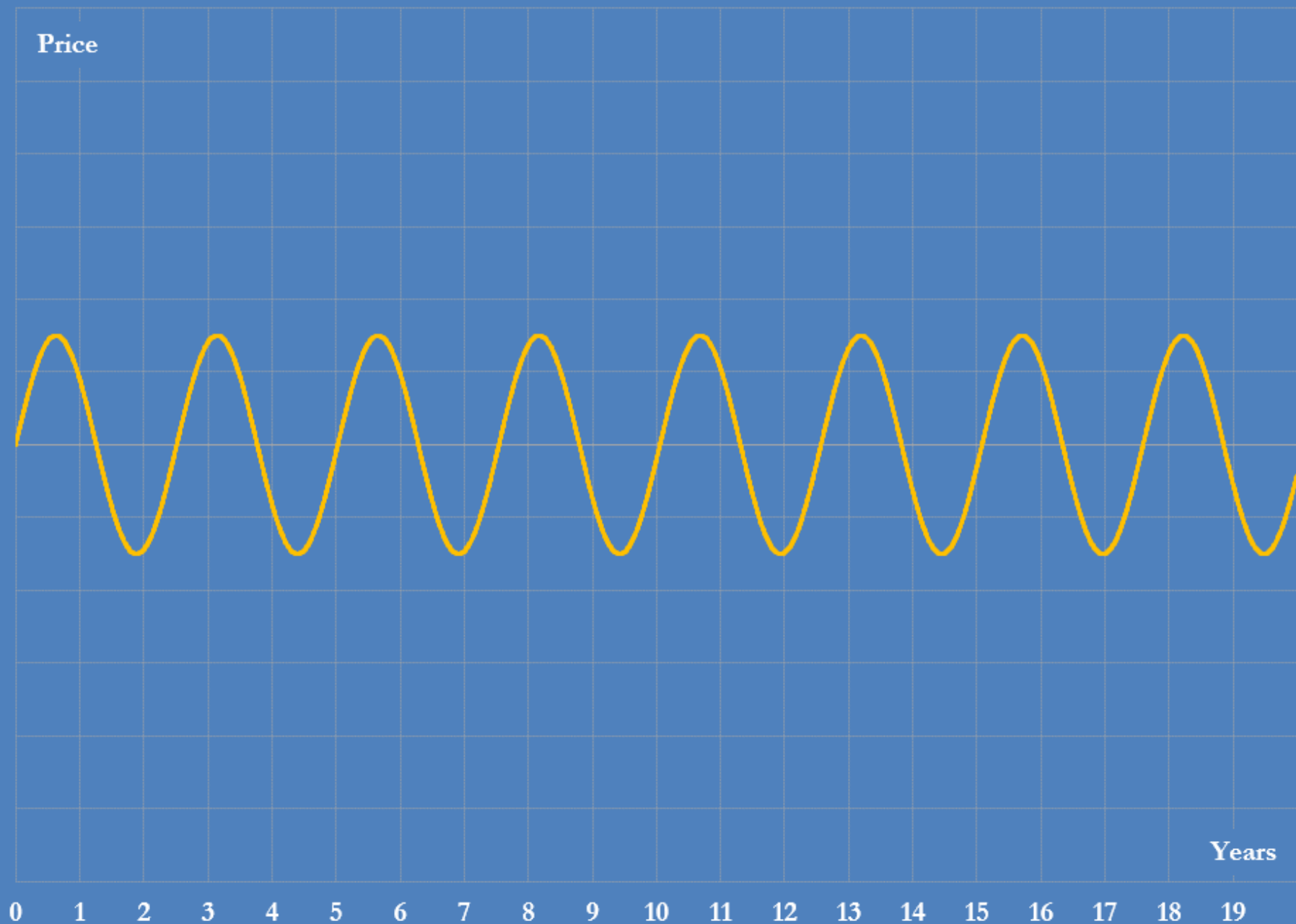
Oil prices

macroeconomic business cycle and oil industry investment cycle (5-10 yrs)



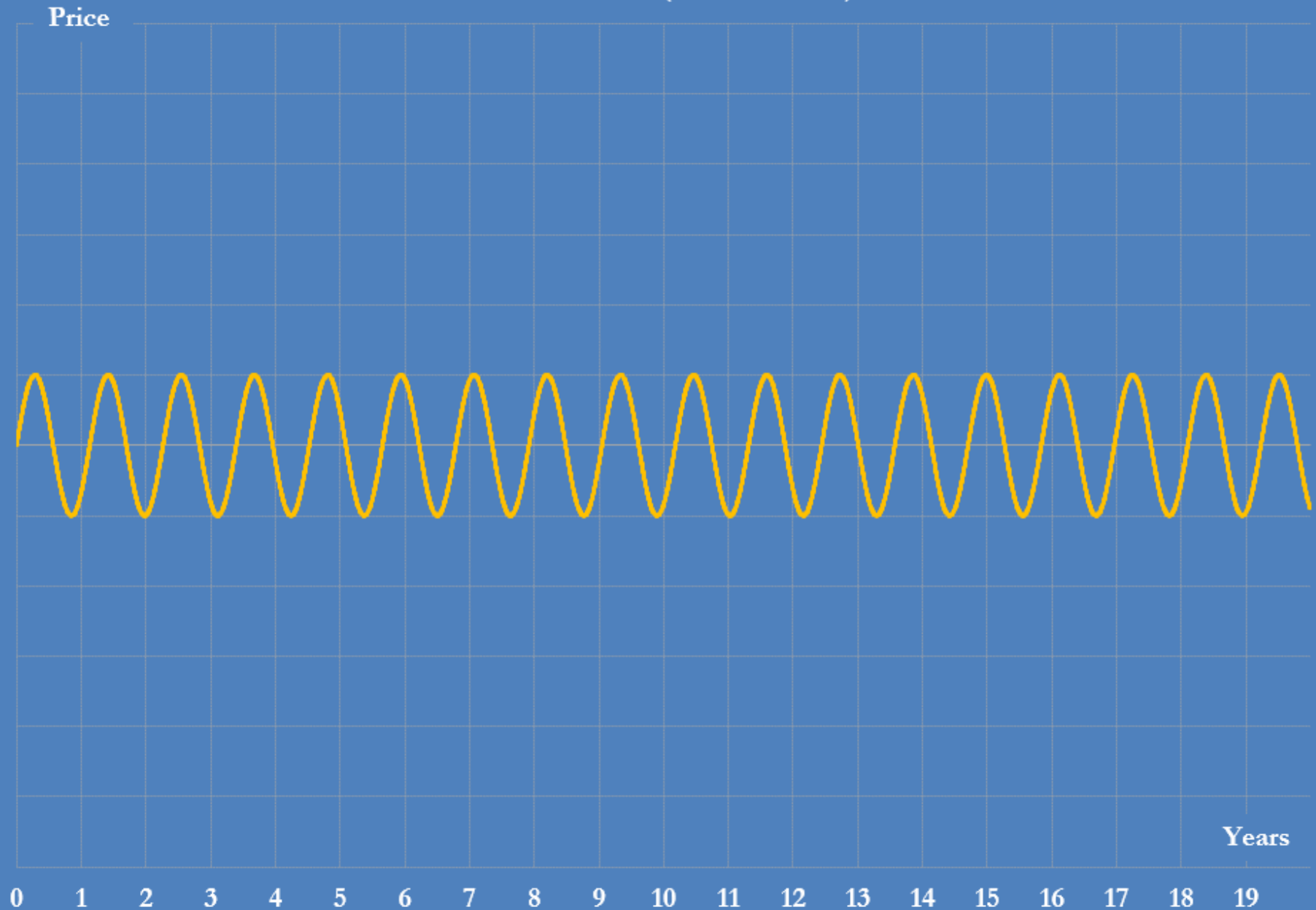
Oil prices

oil industry inventory cycle (2-3 years)

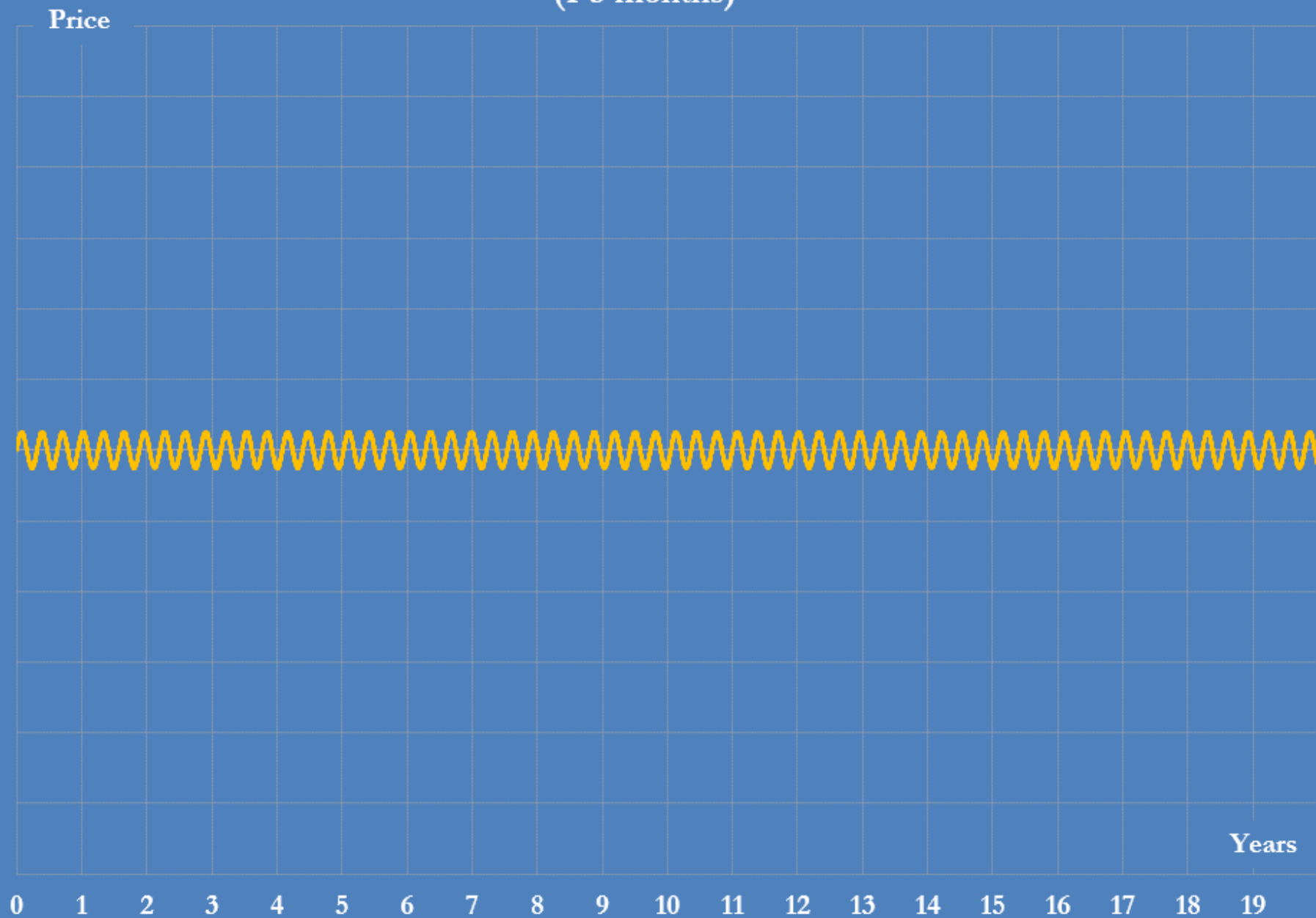


Oil prices

short-term weather impact, supply disruptions, political risk, cross-market correlations (3-12 months)

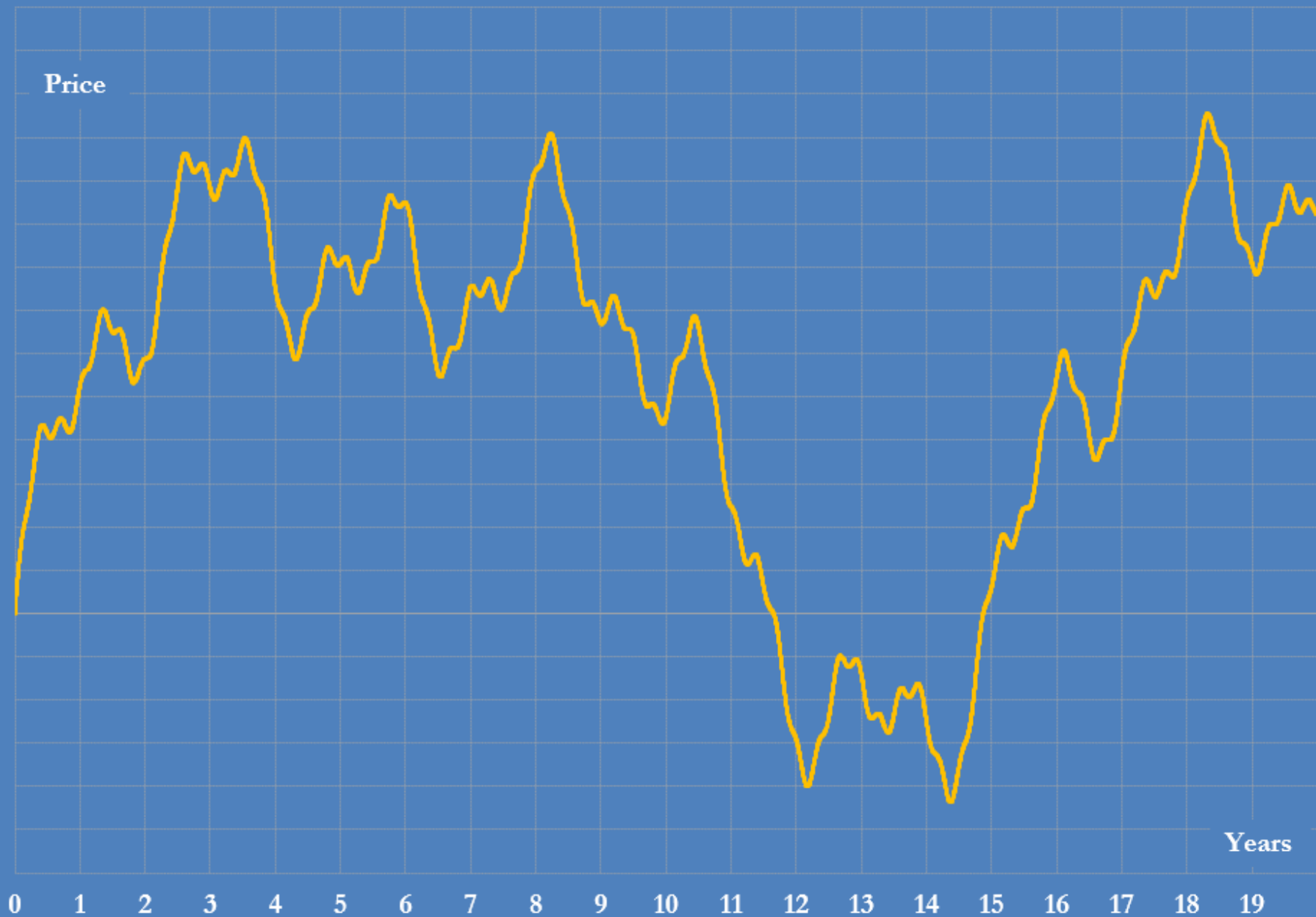


Oil prices ultra-short term cycles caused by trading (1-3 months)



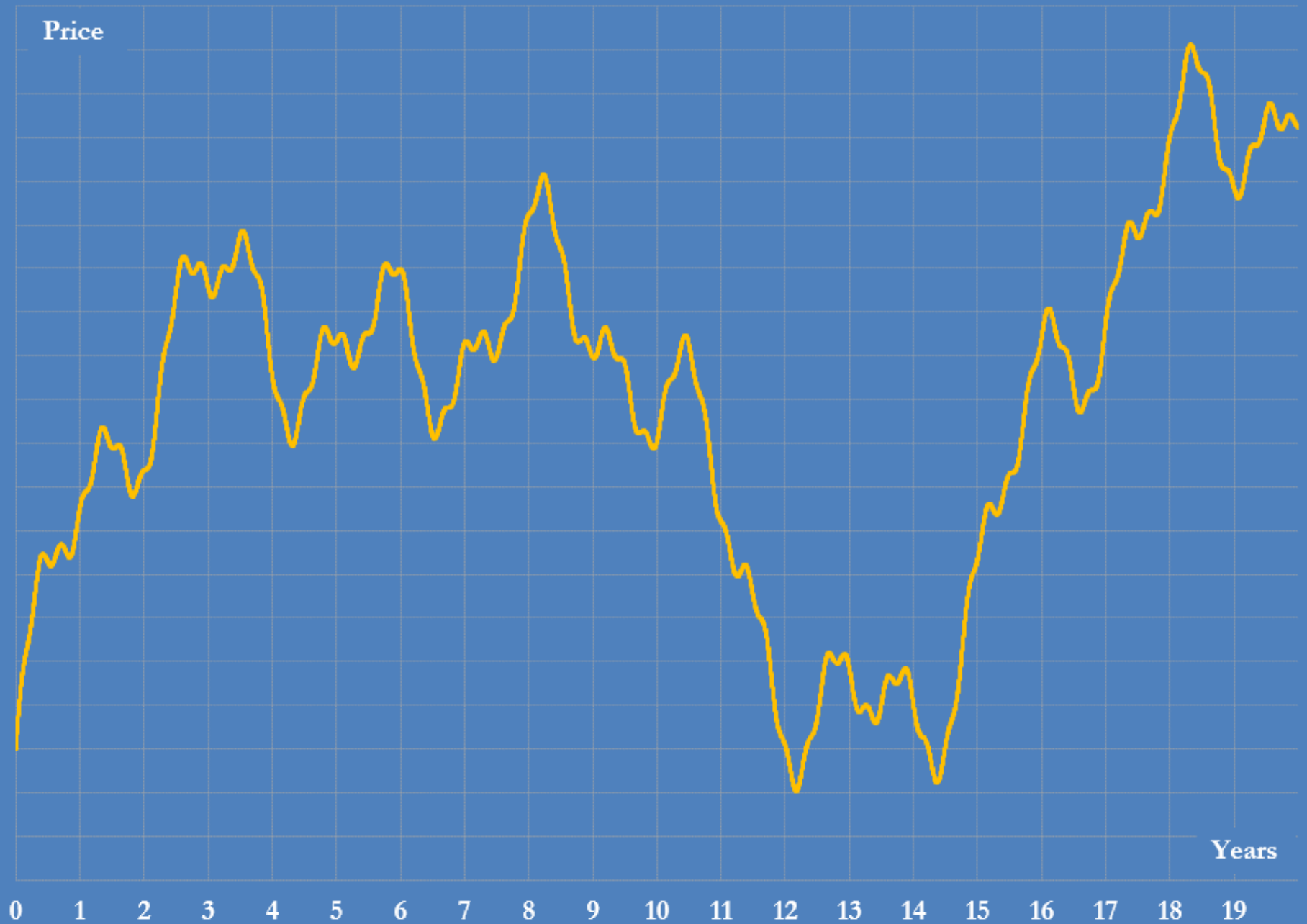
Oil prices combined cycles

supercycle + business cycle + inventory cycle + short-term cycles + ultra short cycles



Oil prices

combined cycles with long-term inflation-driven uptrend



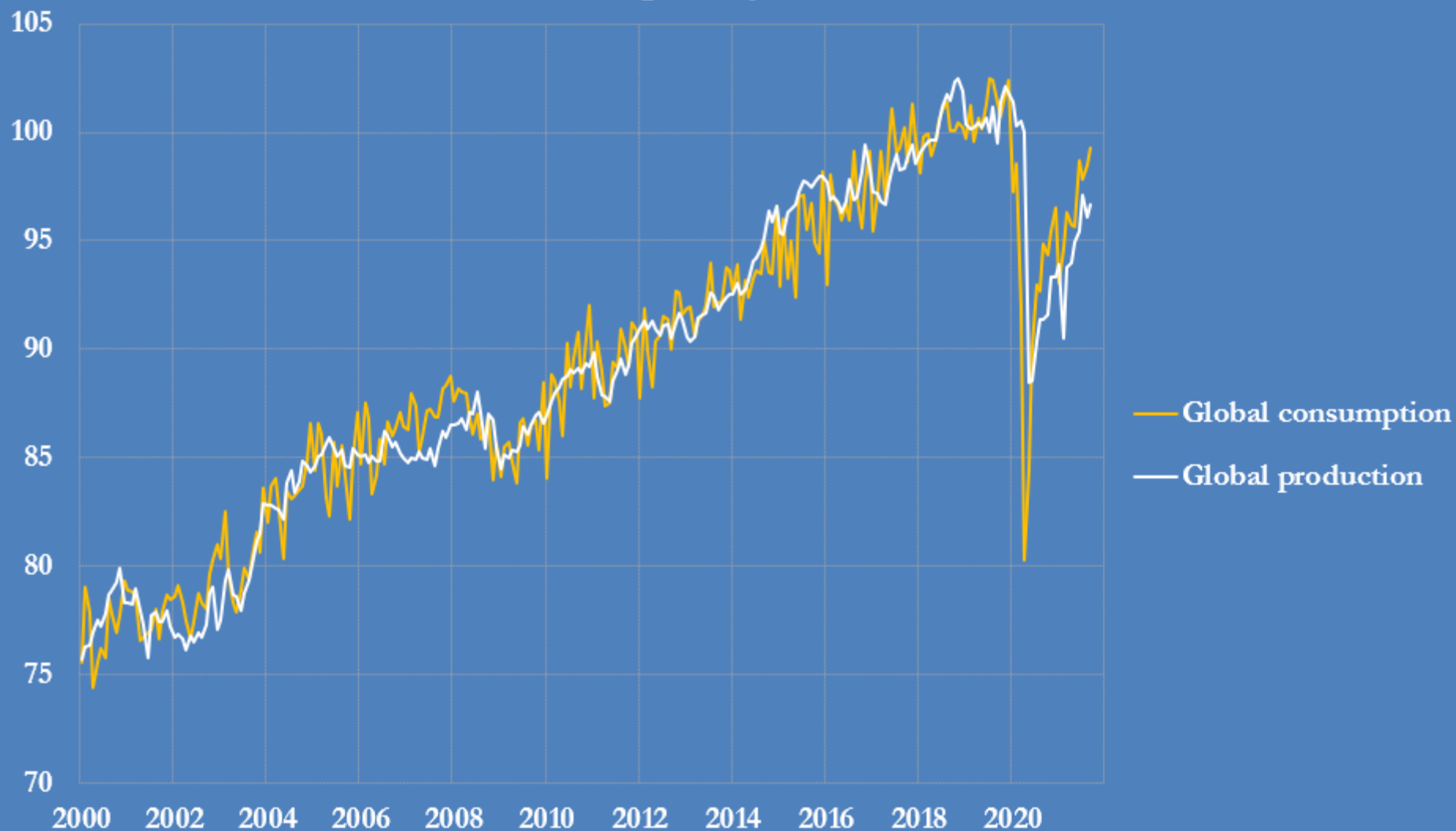
Global petroleum market cycle - prices and inventories

PHASE	CYCLICAL POSITION	SPOT PRICES	CALENDAR SPREAD	INVENTORIES	OPEC RESPONSE
I	Early cyclical upswing	Increasing Accelerating rate	Contango → Backwardation	High Falling	OPEC compliance weakens
II	Moving towards peak	Increasing Decelerating rate	Backwardation Widening	Moderate Falling	OPEC agreement dissolves
III	Peak	Level stabilising Extreme daily volatility	Backwardation Narrowing	Low Steadying	OPEC under pressure to raise output
IV	Late cyclical breakdown	Decreasing Slowly	Backwardation → Contango	Moderate Rising	OPEC postpones decision on cuts
V	Slump	Decreasing Rapidly	Contango Widening	High Rising	OPEC agrees to cut production
VI	Trough	Level stabilising Extreme daily volatility	Contango Narrowing	High Steadying	OPEC focuses on compliance

Global petroleum market cycle - production and consumption

PHASE	CYCLICAL POSITION	OPEC PRODUCTION	NON-OPEC OUTPUT	CONSUMPTION
I	Early cyclical upswing	Output restraint Compliance weakens	Falling Decelerating rate	Growing above trend Low prices spur consumption
II	Moving towards peak	Restraint relaxed Compliance dissolves	Rising Accelerating rate	Growing above trend Economic expansion spurs use
III	Peak	No restraint Maximum output	Rising Rapidly (boom)	Growing below trend High prices inhibit consumption
IV	Late cyclical breakdown	No restraint Pump at will	Rising Decelerating rate	Growing below trend High prices inhibit use
V	Slump	Fiscal crisis Cuts agreed	Falling Accelerating rate	Growing below trend Oil producers in recession
VI	Trough	Cuts implemented Compliance high	Falling Rapidly (bust)	Growing above trend Low prices spur consumption

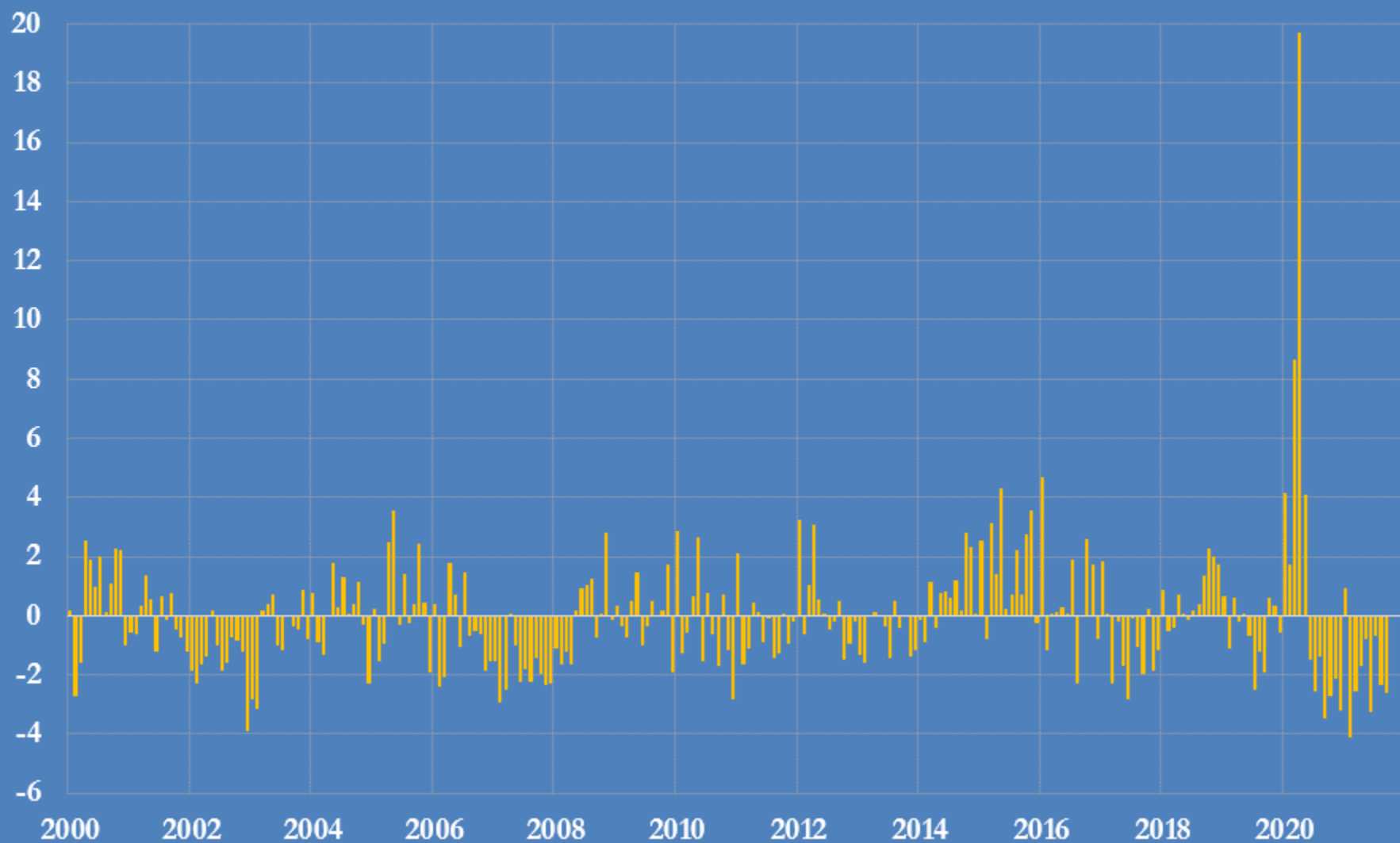
Global oil consumption and production, 2000-2021 million barrels per day



Source: U.S. Energy Information Administration

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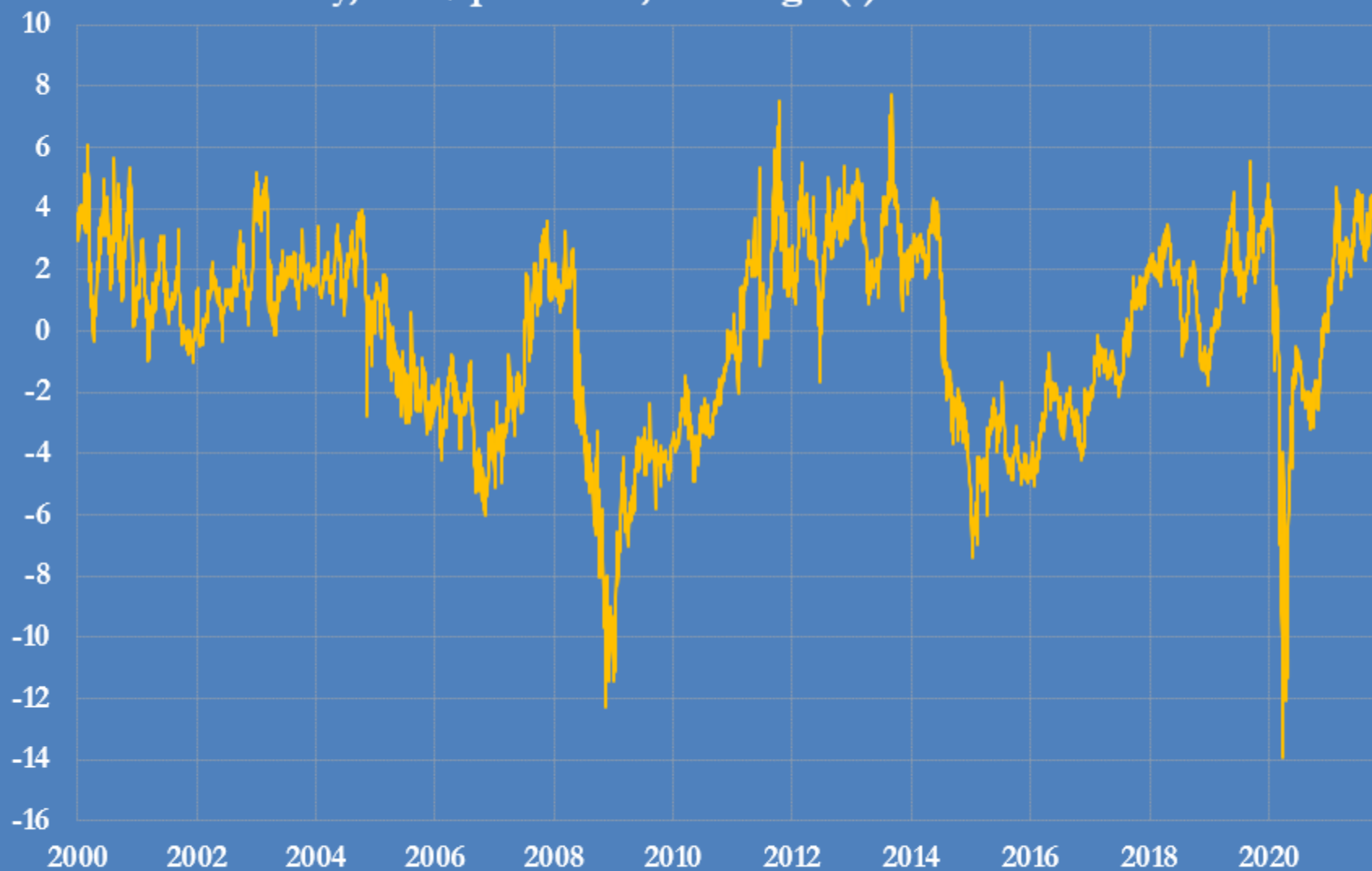
Global production-consumption balance, 2000-2021 million b/d, overproduction (+) and underproduction (-)



Source: U.S. Energy Information Administration

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Brent six-month calendar spread, 2000-2021 daily, U.S.\$ per barrel, contango (-) or backwardation

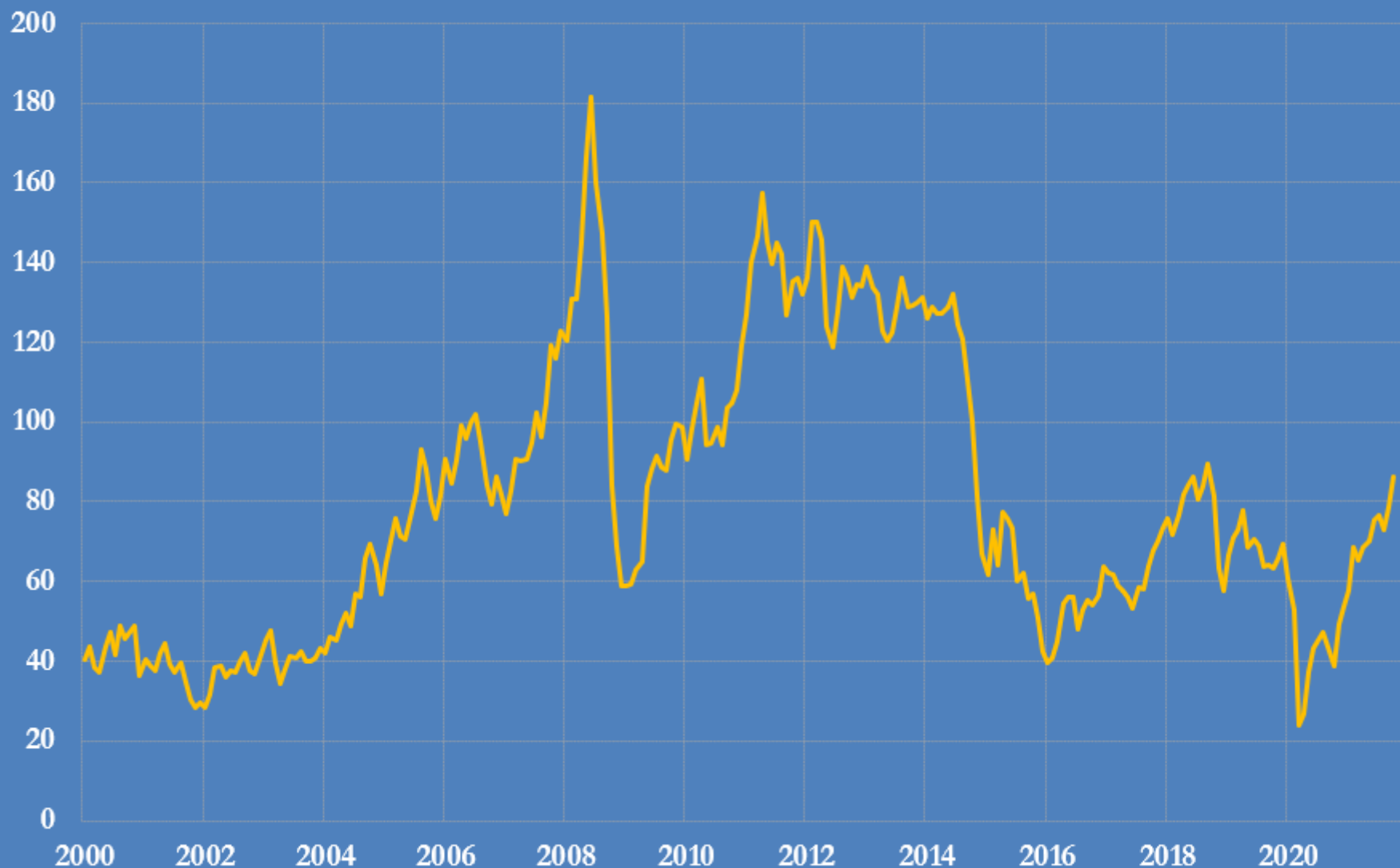


Price difference Brent month 1 and month 7 (U.S.\$/bbl)
Contango (-) or backwardation (+)

Source: ICE Futures, @JKempEnergy

Brent crude prices, 2000-2021

end-month, except most recent month, adjusted for inflation, 2021 U.S\$/bbl



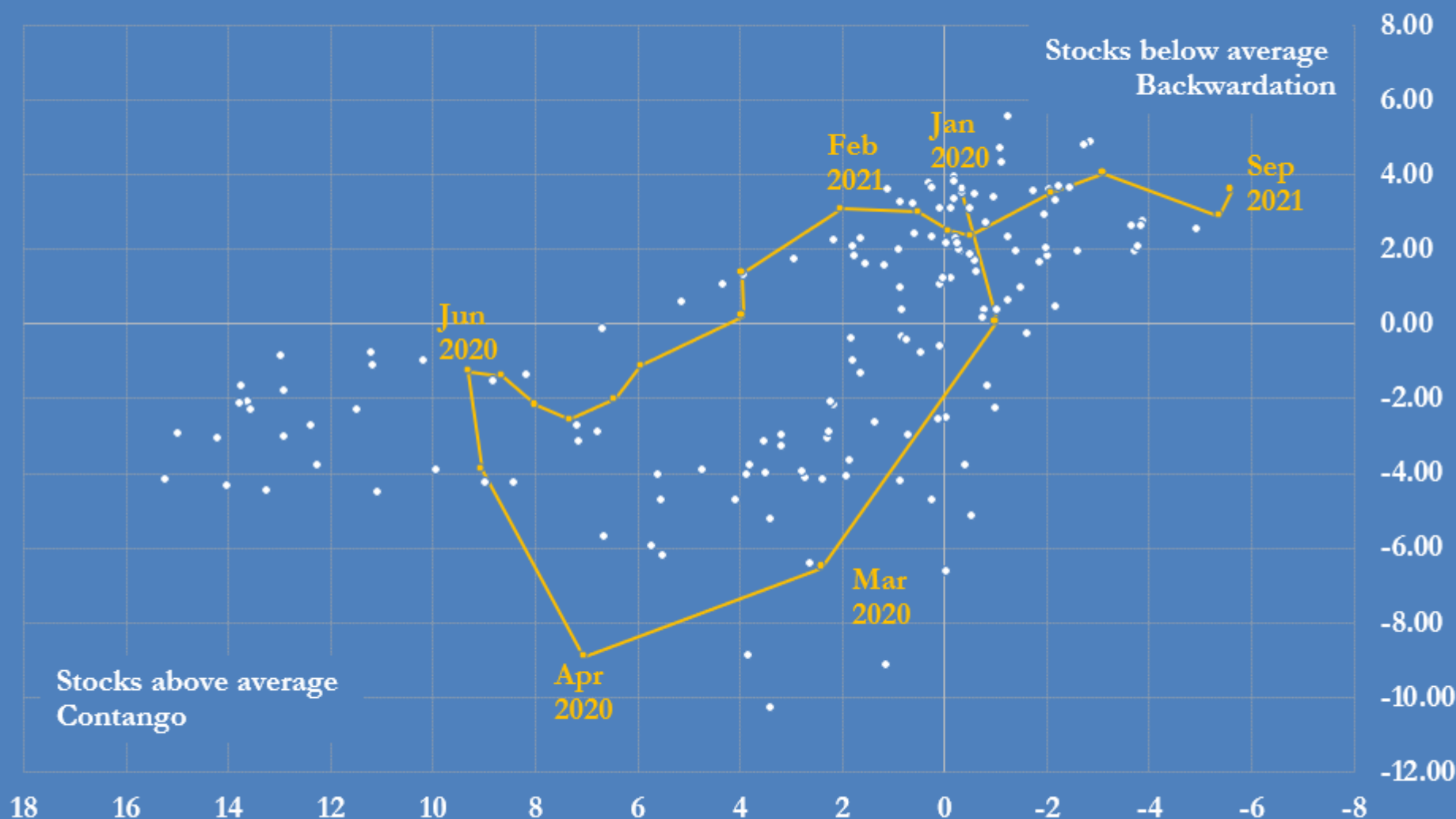
Source: ICE Futures Europe, U.S. Bureau of Labor Statistics

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Global petroleum market, monthly data, 2008-2021

X-axis: OECD commercial stocks (percent change from prior 5yr average, excl 2020)

Y-axis: Brent calendar spread (six-months, U.S\$/bbl, contango (-) or backwardation (+))

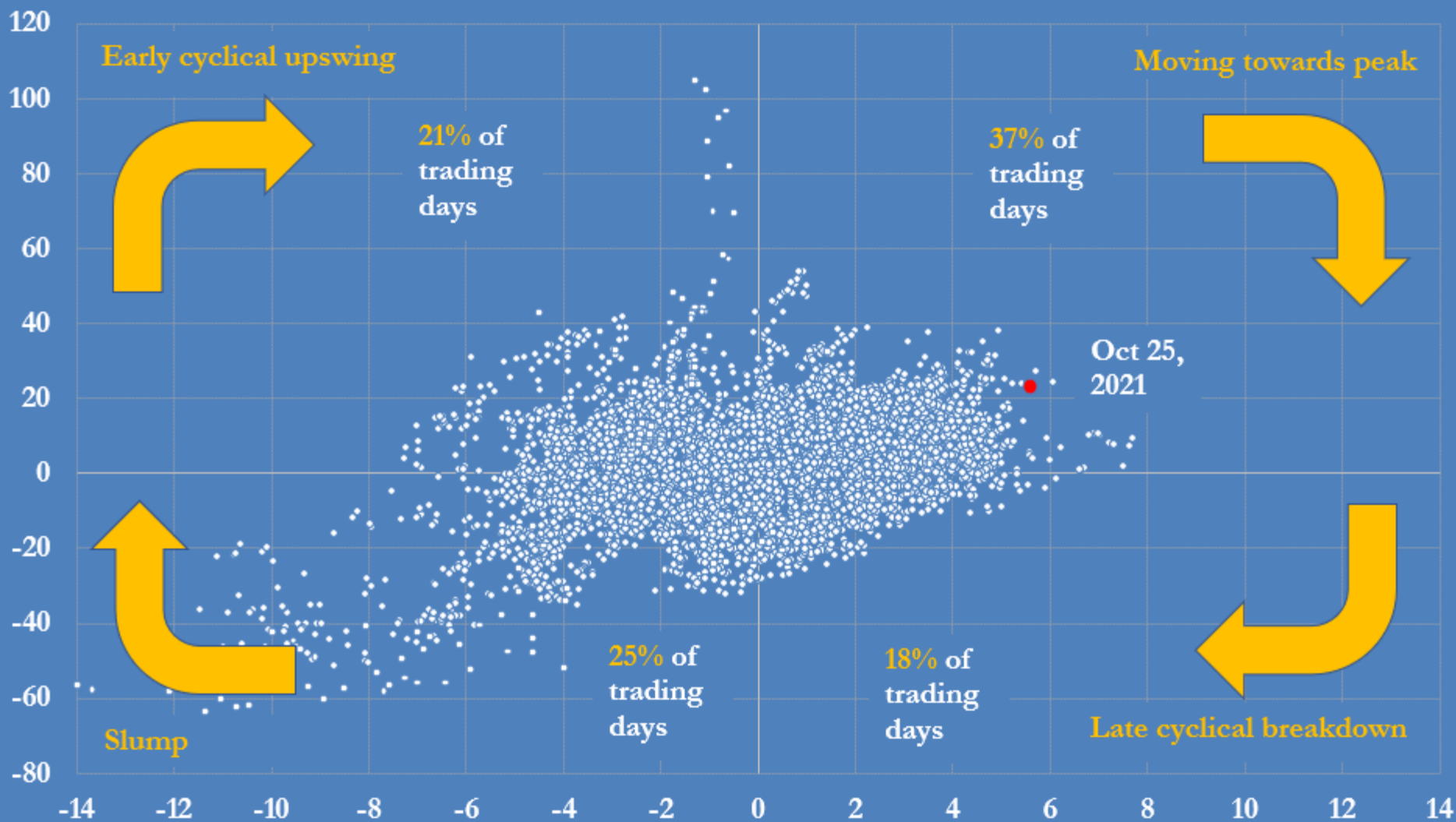


Sources: U.S Energy Information Administration (Short-Term Energy Outlook), ICE Futures Europe
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Brent spot prices and calendar spread, 1993-2021

X-axis: six-month calendar spread (M1-M7) (U.S\$ per barrel)

Y-axis: percent change in spot price over previous two months (five-day avg)



Source: ICE Futures Europe

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