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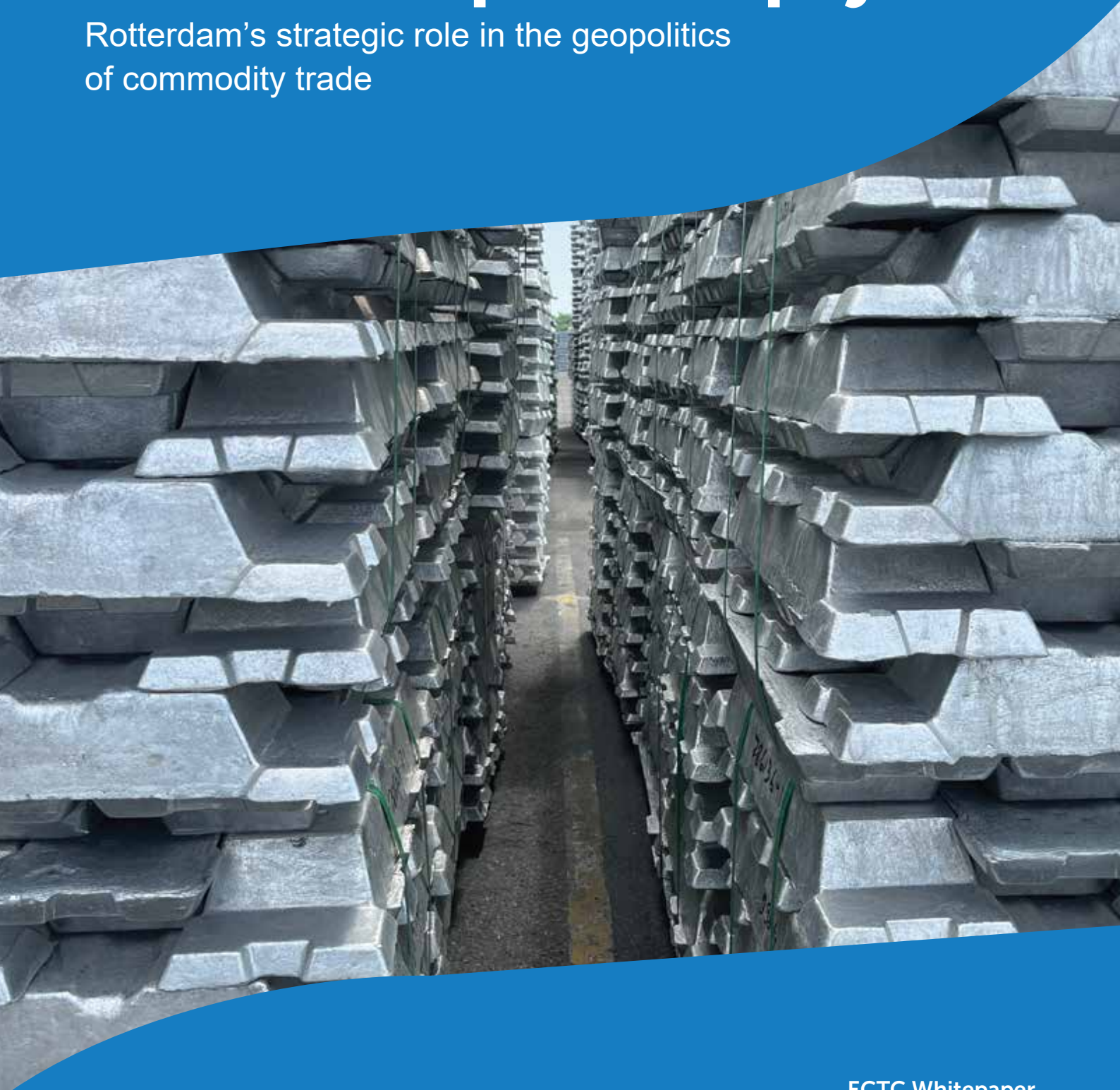
What is the price we pay?

Rotterdam's strategic role in the geopolitics of commodity trade



ECTC Whitepaper

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Purpose of this whitepaper

This whitepaper shows how **Rotterdam's role as a commodity pricing centre** can strengthen the European Union's security of supply of strategic commodities. To do so, the paper discusses the geoeconomic dimension of commodity price formation, and explains the functions of commodity price discovery and pricing centres. The paper finishes by explaining how more commodities can be priced in Rotterdam and proposes several commodities for this.

Target audience

This whitepaper is intended for Dutch and European policy audiences concerned with European security of supply, market development, trade and international competitiveness in raw materials. This includes port authorities, and local, provincial, national and EU institutions, including but not limited to the Port of Rotterdam, Municipality of Rotterdam, Province of South Holland, Netherlands Ministries of Economic Affairs and Climate, Finance, Foreign Affairs, and Infrastructure and Water, the Netherlands Authority for the Financial Markets (AFM), the European Commission's Directorate-Generals ENER, FISMA, GROW, JRC and TRADE, and the European Securities and Markets Authority (ESMA).

About Erasmus Commodity & Trade Centre

Erasmus Commodity & Trade Centre (ECTC) is a commodity industry think tank and talent platform offering applied research & advisory, academic education and executive education. ECTC is a part of Erasmus University Rotterdam, a public research university in The Netherlands.

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Executive Summary

> *We will establish reference prices for critical minerals at each stage of production, pricing that reflects real-world, fair-market value."*
>
> *— JD Vance, US Vice President, 4 February 2026.*[1]

EU supply security is undermined by the US-China race to set terms in raw materials trade

The second Trump administration is positioning the US as the dominant player in global commodity markets — whether by becoming a leading exporter of oil and liquefied natural gas (LNG), or by pressuring China to buy more US soybeans within the US-China trade war. In retaliation, China's government has restricted its minor metals exports. These moves aim to secure cheaper raw materials for domestic industries, generate revenue and create geopolitical leverage over rivals. Such actions erode the ability of the European Union (EU) and its member states ability to secure supply and favourable prices in global commodity markets.

The EU needs to leverage price formation to secure its supply of (critical) raw materials

As a net importer of many energy and metals commodities, the EU is disadvantaged by where and how commodity prices form, and must respond strategically. Security of supply is not only about developing production assets — it requires an ecosystem with the right price signals. The response begins with a paradigm shift from supporting individual supply projects to stimulating a European integrated capital market that uses future commodity delivery mechanisms to:

- Inform decision-making on capital expenditure (CAPEX), operating expenditure and debt financing of assets by improving price discovery in strategic value chains that have opaque pricing mechanisms for raw materials;
- Provide liquidity by allowing risk capital to be allocated to commodities as an alternative investment class via financialised exchange mechanisms;
- Endorse the Euro by obligating the physical delivery of globally-traded commodities in the EU to be denominated in Euros;
- Enable supportive institutional, market-informed mechanisms that allow for strategic policy interventions such as government-mandated stockpiling.

Pricing centres such as Rotterdam are key to commodity price formation

By virtue of their location, proximity to supply and demand, and complementary functions, pricing centres serve as physical reference points for trade. Price benchmarks form at these hubs because this is where most transactions occur, creating a positive feedback loop that attracts more supply and more market participants, including suppliers, buyers, traders and financiers. **Rotterdam sits at the core of the Amsterdam-Rotterdam-Antwerp (ARA) polycentric port-industrial cluster, which is already the EU's main commodity pricing centre. With the right incentives, it could price others.**[2]

1. US Department of State, *Opening Remarks of the Critical Minerals Ministerial*, 4 February 2026, https://tinyurl.com/bdd9224s.
2. K. van den Berghe et al., "Friends with Benefits: The Emergence of the Amsterdam-Rotterdam-Antwerp (ARA) Polycentric Port Region," *Territory, Politics, Governance 11,* no. 2, 2023: 301-320, https://doi.org/10.1080/21622671.2021.2014353.

Rotterdam already strengthens European raw material security of supply in three ways

Rotterdam's role as the EU's main pricing centre enhances the availability, accessibility and affordability of commodities through the following mechanisms:

- **Aggregating liquidity:** The binding constraint of price discovery is liquidity, or the ease with which a commodity can be bought or sold. Commercial value in commodity markets is created through optionality — the ability to transform commodities across time, space and form, while mitigating risk. Market participants gravitate towards pricing locations where this optionality is greatest, such as industrial and logistical nodes. Pricing centres therefore aggregate not only committed physical supply, but also liquid supply that can change ownership. This means the pricing centre hosts diversified supplies that span multiple producers, origins and material grades, as related products trade against a benchmark at discounts or premia. If one supplier is disrupted, others can arbitrage into the benchmark and provide alternative supply.
- **Absorbing market shocks:** Reliable price discovery informs decision-making during supply and demand shocks. Optionality at the hub stimulates surplus capacity, giving market participants more arbitrage options on physical cargoes and allowing the hub to absorb demand surges and release inventory against benchmark prices. For example, in response to the February 2026 crisis in the Strait of Hormuz, the benchmark pricing of jet fuel in Rotterdam provided the market with a reliable price signal to which regional oil refineries quickly responded with an increased supply of jet fuel.
- **Financial signalling:** Price benchmarks strengthen the financing and credit risk profiles of project developers and commodity traders by providing financiers and creditors with an independent forward price signal. This supports business cases for new assets such as critical raw material (CRM) processing plants in the region. Where possible, price benchmarks allow market participants to hedge price risk against the benchmark using financial instruments.

These features make Rotterdam particularly well-suited to security-of-supply measures such as investment in related value chain segments and strategic stockpiling. For example, this is applicable to CRMs identified by the EU, particularly those that the European Commission is considering to stockpile in an upcoming pilot project.

Rotterdam needs to meet three conditions to be a pricing centre for more commodities

Pricing centres require liquidity, trading infrastructure and institutional arrangements to develop. Liquidity generates network effects: more participants improve prices, which attracts more volume, enabling more financing, supporting more inventory and sustaining more trading activity. Liquidity must be reinforced by efficient trading infrastructure, both physical (storage and logistics) and digital (market-making platforms, clearing houses and commodity exchanges). Finally, credible institutional arrangements — institutions and governance frameworks — have to effectively balance public price discovery and individual incentives for liquidity provision.

Rotterdam's potential to be a pricing centre for more commodities

Rotterdam is already both a European and global commodity pricing centre, serving as a benchmark for aluminium, antimony, tungsten, crude oil, oil products, bunker fuels, coal, natural gas (its Gate LNG terminal is a key node for the Dutch TTF benchmark), grains, oilseeds, soft agricultural commodities and biofuels. To support the EU's sustainability and strategic autonomy goals, the hub has the potential to develop as a pricing centre for **LNG, ammonia, biofuels,** and select metals on the EU's CRM list — **lithium, manganese and nickel.**

Strategic recommendations

The recommendations focus on three principles: the need for Rotterdam to grow as the globally-competitive European pricing centre, the need to stimulate physical liquidity at the pricing centre, and the need to create an enabling institutional environment at the pricing centre.

Enable Rotterdam to be the globally-competitive European pricing centre

- **European Commission and the Dutch government:** Within the effort to re-build the EU's competitiveness in global markets, enable Rotterdam to be Europe's main commodity pricing centre that can concentrate supply and strengthen European influence in the global price formation of strategic commodities.
- Most commodity derivatives are traded in US dollars.[3] The integration of Europe's capital markets will benefit from an alternative investment class (commodities) that removes the foreign exchange risk with the US dollar. Support the creation of Euro-denominated commodity derivatives on European exchanges to drive financial liquidity into European commodity flows. Coordinate this with futures exchanges, money managers, investment funds, institutional investors, commodity traders and industrials with large commodity price risk exposure, such as automotive, defence, chemical, steel, and airlines.
- **Port of Rotterdam:** Prioritise a set of commodities with high network-effect potential and a realistic path to critical mass, that have optionality to be traded in Rotterdam. This may include LNG, ammonia, biofuels, lithium (carbonate), manganese and nickel (sulphate), though this may change due to geopolitical and market conditions.

Stimulate physical liquidity at the pricing centre

- **Dutch government and Port of Rotterdam:** Use carefully designed liquidity-seeding mechanisms such as volume incentives and reduced port fees to reach price tipping points for chosen commodities. Rotterdam's benchmark expansion will need buy-in from commodity traders that play a key role in providing liquidity and warehousing risk. It may require incentives for market participants to engage in more activity at the hub via schemes like Singapore's Global Trader Programme. Publicly financed extraction and processing assets should be directed to route commodity flows through Rotterdam.
- Track liquidity metrics of commodities shipped through the port, including spreads, depth, participation breadth and price informativeness, alongside traditional volume metrics. Understanding liquidity provides early signals for which commodities can be nudged towards more pricing in Rotterdam.

Create an enabling institutional environment at the pricing centre

- **Port of Rotterdam:** The Port traditionally deals with physical market participants such as producers, off-takers and logistics providers. Bring them together with financial market actors such as commercial banks, institutional investors, money managers, futures exchanges and commodity traders that are key to the functioning of a pricing centre.
- Promote market development initiatives such as HyXchange for prioritised commodities to align physical, financial and regulatory conditions for the pricing centre to form.

3. The only European futures traded in Euros are power, natural gas, European emission allowances, wheat, potatoes, corn, salmon, rapeseed and soon, dairy. Euronext Markets, https://live.euronext.com/en/products/commodities.

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Glossary

Term	Explanation
Arbitrage	The practice of simultaneously buying and selling a commodity in different markets or forms to profit from temporary price discrepancies.
Basis	The difference between a cash (spot) price and the futures contract price for a commodity.
Basis risk	The financial risk that a cash (spot) price of a commodity and the futures contract do not move in tandem, causing an imperfect hedge.
Cost, insurance, freight (CIF)	An Incoterm rule requiring the seller to pay for transport, export clearance, and minimum insurance to a named destination port.
Commodity exchange	A regulated, centralised marketplace for trading standardised commodity contracts.
Counterparty risk	The risk that a buyer or seller (counterparty) defaults on their contractual obligations, such as failing to deliver physical goods, making payments.
Forward contract	A customised over-the-counter (OTC) agreement between two parties to buy or sell a specific quantity of a commodity at a set price on a future date.
Free-on-board (FOB)	An Incoterm rule for transport of bulk and general cargo by water. The seller delivers the goods on board the vessel at the agreed port of departure.
Futures contract	A standardised, legally binding agreement traded on an exchange to buy or sell a specific quantity of a commodity at a set price on a future date.
Hedge/hedging	A risk management strategy used by buyers and sellers to protect against adverse price volatility by taking opposite positions in derivative markets.
Incoterms	A set of 11 widely used rules that define the responsibilities of sellers and buyers for the sale of goods in international transactions (e.g. EXW, CIF, CFR, FOB).
Liquidity	The ease with which a commodity can be bought or sold quickly without causing a significant impact on its price, and the costs associated with that transaction.
Optionality	Used synonymously with flexibility. Note: not used in the context of contract optionality.
Over-the-counter (OTC)	Contracts negotiated directly between two parties instead of a centralised exchange.
Price benchmark	The reference point price for a good with consistent quality and wide availability. It acts as a baseline to price other goods in the same category.
Price discovery	The process of determining the spot or future price of a raw material through the interaction of buyers and sellers, balancing supply, demand, and market information.
Price risk	The potential for financial loss or reduced profitability caused by unexpected fluctuations in the market price of raw materials.
Pricing centre	Major (global) hub that establishes benchmark prices for specific commodities. It is a reference point for (global) trade, offering transparency, liquidity, and price discovery.
Spot price	the current, real-time market (cash) price at which a commodity can be bought or sold for immediate payment and delivery.
Supply risk	The potential for financial loss or operational disruption caused by shortages, delays, or failures in receiving physical commodities.

1 Introduction: Commodity pricing as a geoeconomic tool

> *[T]he world that once helped Europe generate prosperity no longer exists. It has become harder, more fragmented and more mercantilist."*
>
> *— Mario Draghi, former President of the ECB, 14 May 2026.*[4]

Commodities are tradeable agricultural, energy and mineral raw materials that are interchangeable with others of the same type, such as crude oil, grain or iron ore. They are a financialised asset class that underpins the real-world economy dependent on the trade and supply of natural resources. Recent geopolitical crises have underscored the global supply risks in many commodities. The most recent example is the US/Israeli attack on Iran in February 2026, the subsequent closure of the Strait of Hormuz, and resulting disruptions to supplies of crude oil, natural gas, fertiliser, aluminium, sulphur, helium and other commodities.

The Russian invasion of Ukraine in 2022 already exposed the EU's vulnerability to commodity supply disruptions, forcing a reassessment of established supply chains — particularly its dependence on Russian natural gas, nickel, aluminium, crude oil, petroleum products, and fertilisers. Further vulnerabilities have since emerged: Chinese dumping of biofuels in the EU, minor metals shortages caused by Chinese export restrictions, and growing reliance on US LNG to replace Russian piped gas. The EU's response has focused on three broad strategies: diversifying supplies, improving efficiency of use, and expanding recycling. REPowerEU and RESourcEU became the overarching plans for this. The latter builds on the Critical Raw Materials Act (CRMA), which had designated 34 metals and minerals as critical.

Box 1

The EU CRMA material list

The EU's fifth CRM list released in 2023 has 34 'critical' materials. Those also designated 'strategic' are shown in bold:[5] **Aluminium/bauxite, coking coal, lithium,** phosphorus, antimony, feldspar, **light rare earth elements (LREE),** scandium, arsenic, fluorspar, magnesium, **silicon metal,** baryte, **gallium, manganese,** strontium, beryllium, **germanium, natural graphite,** tantalum, **bismuth,** hafnium, niobium, **titanium metal, boron/borate,** helium, **platinum group metals, tungsten,** cobalt, **heavy rare earth elements (HREE),** phosphate rock, vanadium, **copper** and **nickel.**

Since then, energy and metals have become a focal point of Sino-American competition, further straining the availability, accessibility and affordability of these commodities for the EU. The recently announced US Forum on Resource Geostrategic Engagement (FORGE) aims to use coordination on price formation, trade and investment as a competitive tool against China's market power in CRMs.[6] FORGE's stated goal is to pool enough market participants to influence price formation in metals markets where China is a near-monopoly supplier. While other countries may benefit, the primary objective is to strengthen the US position. As Box 2 illustrates, the US is already pursuing this through several means.

4. Union of European Federalists, *Mario Draghi's speech in Aachen*, 2026, https://federalists.eu/federalist-library/mario-draghis-speech-in-aachen-14-05-2026/.
5. The 'critical' designation reflects high economic importance combined with a high risk of supply disruption; 'strategic' materials additionally face expected rapid demand growth and have particularly complex value chains.
6. Reed Blakemore and Alexis Harmon, *US critical minerals policy goes collaborative with FORGE*, Atlantic Council, 12 February 2026, https:tinyurlcom/5n854rwj.

Countries can influence markets in many ways; this paper focuses on one key mechanism: price discovery — the process of determining a mutually agreed price between buyers and sellers. Commodities are first and foremost physical cargoes, which means that the locations where prices are discovered — pricing centres — are central to market functioning. For European policymakers seeking to strengthen the position of the EU member states and the EU in global supply chains, understanding the functionality of pricing centres and how pricing centres emerge, evolve and can be supported by strategic interventions is essential.

Box 2

The US is challenging China's price-setting power in rare earth elements

In many minor metals on the EU CRM list, global prices are discovered in China because most transactions take place there.[7] China is the world's leading refiner and exporter of rare earth elements (REEs). REEs are traded via opaque over-the-counter (OTC) deals, with prices benchmarked to voluntarily submitted data from China-based reference points. These provide some transparency, but only a limited and subjective view of the market. For the key REE compound neodymium-praseodymium (NdPr), used in permanent magnets, global prices are benchmarked to Ex-Works (EXW)[8] China by price reporting agencies (PRAs) Asian Metal and Shanghai Metal Market, inherently tying prices to Chinese domestic market dynamics.

In February 2026, US-based Chicago Mercantile Exchange (CME) and Intercontinental Exchange (ICE) were reported to be developing NdPr futures contracts, though the reference locations for these contracts were not disclosed.[9] Meanwhile, PRAs recently established new European and North American price references. For Europe these are Fastmarkets (Nd oxide and Pr oxide, CIF Rotterdam, since 2024),[10] Benchmark Mineral Intelligence (NdPr oxide, CIF Europe, since 2025)[11] and Argus (Nd oxide/metal, CIF Europe, since 2025).[12]

Asian Metal's NdPr index (priced in Chinese renminbi) also underpins a landmark US Department of Defense (DoD) agreement establishing a price floor for MP Materials' NdPr production in the US.[13] In the agreement, the DoD has the option to switch the NdPr reference price point from Asian Metal to another internationally recognised pricing location ex-China. This may create further stimulus for ex-China NdPr price discovery.

Trading volume is a precondition for futures contract viability, and it remains unclear whether NdPr is sufficiently liquid to support one. As Chapter 2 explains, **establishing a futures market without an underlying liquid spot market is unlikely.**

7. SAFE, *Critical Minerals Pricing Mechanisms Issue Brief,* December 2025, https://tinyurl.com/mpkcnsfh.
8. EXW is an Incoterm rule where the seller makes goods available at their own premises such as a factory or warehouse for collection, placing minimal obligations on them.
9. Eric Onstad and Pratima Desai, *Exclusive: CME looks into launching first ever rare earth futures contract, sources say,* 11 February 2026, https://tinyurl.com/4acj82h7.
10. Fastmarkets MB, *Rare earths: Methodology and price specifications,* August 2025, https://tinyurl.com/r6eava9v.
11. Benchmark Minerals, *Rare earth prices show regional bifurcation following export restrictions imposed by China,* 6 August 2025, https://tinyurl.com/fe2ubxvp.
12. Argus Media, *Argus Rare Earths Analytics Service,* https://tinyurl.com/mryus2dp.
13. Andy Home, *West needs its own pricing to escape China's rare earths grip,* Reuters, 20 February 2026, https://tinyurl.com/4u5y9apw.

2 Rotterdam's value as Europe's pricing centre for supply security

Rotterdam is Europe's largest port by a large margin based on cargo volume throughput.[14] As Europe's largest port-industrial cluster, the ARA region has long served as the continent's pricing centre across numerous commodity supply chains (see Box 3), a function it continues to fulfil today as Rotterdam transships a large share of commodities to meet industrial demand in Europe's heartland. In the case of CRMs, The Netherlands is the EU's largest importer of CRMs from outside the EU, which signals its potential pricing center role in this commodity segment.[15] Rotterdam is Europe's best-positioned hub to assume the pricing function for a number of emerging and maturing commodity flows.

In the physical market, Rotterdam and the ARA region host Europe's largest share of appropriate storage facilities and logistics providers. For liquid bulk cargo, such as biofuels, this includes a network of liquid tank storage and pipelines that connect it directly to industrial users in the Netherlands, Germany and Belgium. For dry bulk cargo, such as many CRMs, Rotterdam hosts the largest share of LME and Minor Metals Trading Association (MMTA) approved warehouses. LME approved warehouses serve as delivery locations for exchange traded contracts, while MMTA warehouses serve for OTC and spot traded contracts.

Box 3

Rotterdam's existing European pricing function

Rotterdam itself is Europe's physical gateway for commodities, but it is also often the contractually referenced price benchmark for physical deliveries elsewhere in the EU. For instance, an oil delivery in Germany, a corn delivery in Portugal or a tungsten delivery in Poland will often be priced against a Rotterdam benchmark with a location premium added for the specific delivery. This means European industries benefit from price transparency anchored close to home, rather than referencing prices discovered in distant markets such as China, Brazil or the US. For example, Rotterdam is the regional price reference location for oil products such as jet fuel and gasoline, while for natural gas, LNG deliveries at Rotterdam's Gate LNG terminal provide an important physical foundation for the Dutch TTF benchmark — one of the three principal global reference prices for natural gas.

The port's role in forward and futures contracts goes hand-in-hand with its physical hub function. Rotterdam has existing interfaces to financial market participants — commodity traders, commercial banks and futures exchanges. This offers a connection between the physical and financial markets in the commodification of raw materials and the expansion of their European pricing in Rotterdam.

14. Port of Rotterdam, *Annual Report 2025*, https://tinyurl.com/mwrupvt5; Port of Antwerp-Bruges, *Port of Antwerp-Bruges ends 2025 with resilience in a turbulent trading climate,* 27 January 2026, https://tinyurl.com/48swaw3m.
15. Nieke Aerts et al., *Nederlandse afhankelijkheid van kritieke materialen*, CBS, 2025, https://tinyurl.com/476vvkd6.

3 Price discovery in commodity markets

Commodity markets develop through the evolution of market infrastructure. Every commodity market has its own distinct characteristics, geographic distribution, and supply and demand fundamentals, but most follow a similar three-phase 'commodification' pathway in which the price discovery process evolves. Each phase has its own market properties and introduces a distinct set of trading innovations. This differentiation allows policy interventions to be more targeted to market fundamentals. The three phases are:[16]

1. **Long-term offtake:** This phase is characterised by opaque OTC long-term offtake agreements between buyers and sellers. With limited supply available, buyers mitigate supply risk by securing these agreements with producers, while producers use fixed-price long-term contracts to mitigate price risk and unlock the CAPEX needed for production. Since CAPEX in raw material extraction and processing is often substantial, buyers tend to be large, vertically integrated companies. Price discovery is least transparent in this phase, shaped by opaque bilateral agreements and largely based on free-on-board (FOB) prices in countries of origin. It is sometimes reinforced by PRAs such as Argus, Fastmarkets and Platts, drawing on voluntary price submissions from buyers, sellers and brokers.
2. **Spot market:** Over time, optimised production in integrated supply chains generates 'incremental tonnage' — extra uncontracted supply available for spot sale to third parties. As demand diversifies and supply grows, the spot market expands and becomes more liquid. Spot trades remain bilateral OTC deals with limited price transparency and without sophisticated price risk management. However, growing liquidity and accompanying volatility create demand for standardised delivery contracts and price risk instruments. This introduces forward contracts, which are customised by volume, specifications and delivery location. These allow counterparties to hedge price risk on future deliveries.
3. **Financialised market:** In the final phase, the physical market is accompanied by a mature financial market in which derivatives are traded on commodity exchanges such as ICE, LME and CME. The primary instrument, the futures contract, enables the warehousing and transfer of price risk from physical market participants, who take offsetting positions on exchange-traded futures. Futures reduce counterparty risk, provide transparent price discovery that informs physical spot market transactions, and serve as hedging tools for physical market participants. Price risk is transferred to financial market participants such as investment banks, hedge funds and sovereign wealth funds that are seeking speculative arbitrage opportunities as part of their wider portfolio strategies.

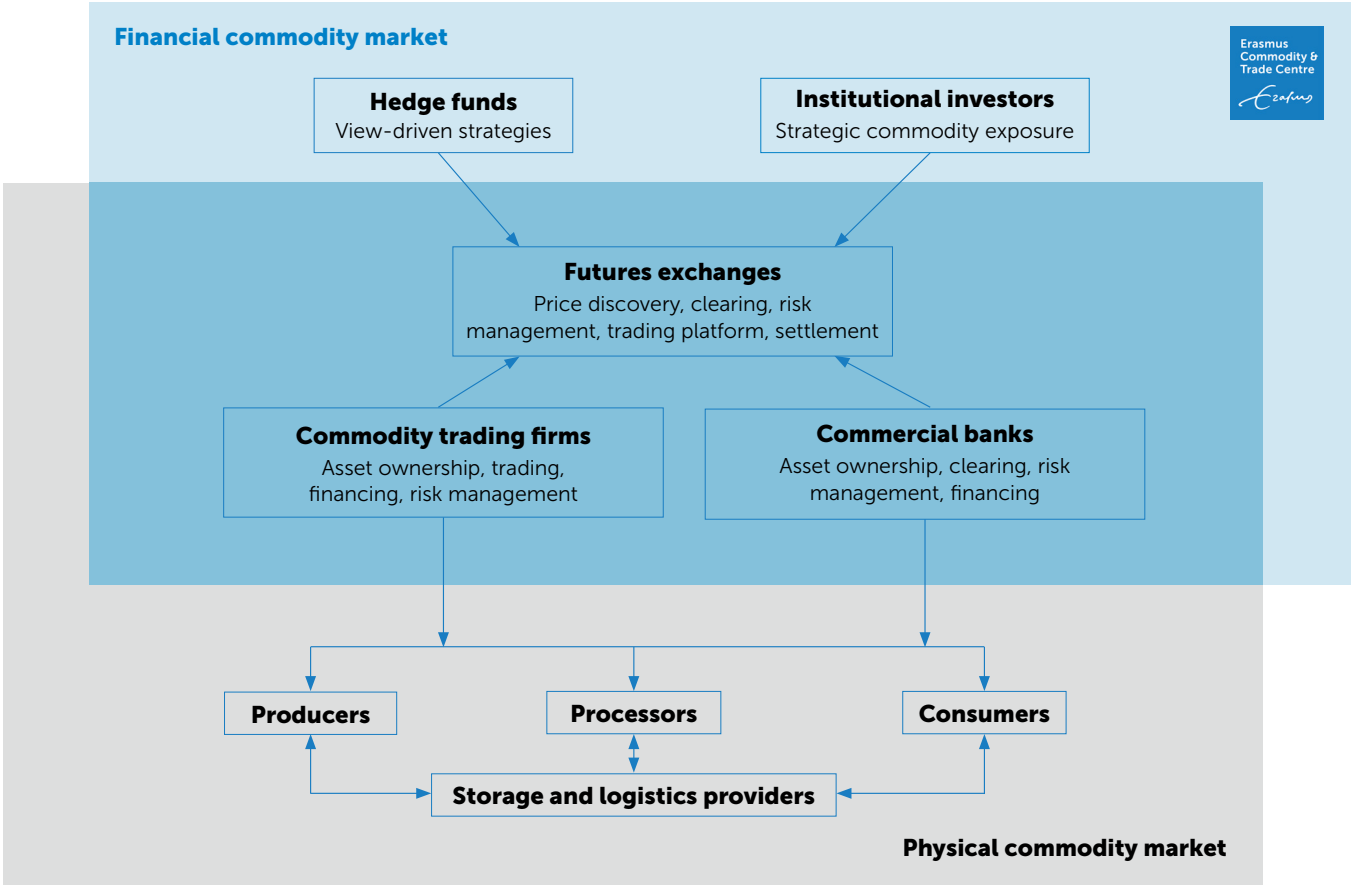
16. Liam van Son, et al., *CommodipHy: The commodification of ammonia and the role of Rotterdam as a global pricing centre.* Research Report, Erasmus Commodity & Trade Centre, 2023. Supported by the Resilient Delta initiative. https://www.eur.nl/en/erasmusctc/media/2023-03-commodiphy-research-report-march-2023.

Table 1. *Representation of the commodification pathway with key features of each market stage.*

Commodification phase	Dominant transactions	Price discovery	Example markets
1. Long-term offtake	Long-term offtake OTC contracts	Transactions, brokers, PRA price reports	Minor metals such as hafnium, scandium, some REEs
2. Spot market	Spot OTC trades and forward contracts	PRA price reports, indices, market platforms	Fruits, hydrogen, gallium, NdPr oxide, crude oil and petroleum products (New York Harbour, ARA, Singapore)
3. Financialised market	Futures contracts and derivatives (options, swaps)	Commodity exchanges such as ICE, LME and CME	Crude oil (WTI, Dated Brent), gold (London Bullion), copper, soybeans

Price discovery begins in the first market phase between suppliers and buyers, with commodity traders entering as market optionality emerges. As the market develops, PRAs contribute more insights — for instance, through more frequent transaction-based price reports. With the shift to a spot market, exchanges and trading platforms provide the infrastructure underpinning price discovery. Commercial banks, institutional investors and hedge funds typically become active in the spot and financialised phases. This is illustrated in Figure 1.

Figure 1: *Key actors in physical and financial commodity markets. In practice, most actors have bilateral connections, but in financialised markets, futures exchanges act as the interconnecting node.*[17]



17. Source: authors, based on Neil Schofield, *Commodity Derivatives: Markets and Applications,* Wiley, 2021, https://tinyurl.com/w55zscxn.

Not all commodities follow the commodification pathway. Some remain low-volume, illiquid and opaque, never reaching the critical mass needed to develop spot or financialised markets. This is particularly true of certain minor metals on the EU's CRM list — such as beryllium, scandium and some REEs — whose volumes are too small to generate the liquidity required for futures-style benchmarking that exists for copper, nickel and aluminium. In more liquid OTC markets such as some REEs, magnesium, manganese, antimony and graphite, PRAs provide price referencing at major supply and demand centres in China, Europe and the US. There is no precise liquidity threshold at which PRAs begin providing price assessments or a spot market forms, but this typically requires multiple daily transactions at a given location, or at minimum multiple bids (what a buyer is willing to pay) and asks (what a seller is willing to offer).

Box 4

The commodification pathway of the ocean-borne LNG market

Long-term offtake (1970s-1990s): Ocean-borne LNG trade began as a niche market, with LNG being expensive relative to legacy energy carriers such as coal and fuel oil. It was pioneered by energy-scarce Japan, which sought to diversify away from those carriers but for which pipeline gas was not commercially viable. Large integrated energy companies identified an opportunity in the price differentials between natural gas produced in the US and Europe and demand in Japan and South Korea. They began investing in liquefaction and regasification assets near export terminals, and dedicated vessels, to lock in transformation margins — the profit generated by altering a commodity's form.

Spot market (1990s-now): LNG spot trading grew for three reasons: physical assets, infrastructure and transport were in place; there was ample uncontracted natural gas supply, particularly from the US, Qatar and Australia; and demand centres diversified as countries moved away from coal-fired power and fuel-oil heating. Commodity trading firms such as Vitol, Trafigura and Gunvor began absorbing and trading the incremental tonnage on the spot market.

Financialised market (2020s-present): Until recently, no futures contracts existed for LNG. Trade was priced relative to piped natural gas benchmarks Henry Hub (HH; US), TTF (Netherlands) and Japan Korea Marker (JKM; Northeast Asia), while offtake agreements continued to govern point-to-point captive supply chains. As waterborne LNG became increasingly spot-traded, however, the arbitrage margins between these benchmarks — spanning liquefaction, transportation and regasification — remained opaque. They were captured by vertically integrated companies, predominantly in the US. In 2024, Abaxx Exchange, a commodity futures exchange, launched physically-settled waterborne LNG futures contracts with prices listed for the Gulf of Mexico, Northwest Europe and Pacific North Asia (the waterborne equivalents of HH, TTF and JKM), improving price discovery and bringing greater transparency to the LNG market.[18]

18. Jamison Cocklin, *Abaxx Sees Possibility for Global LNG Benchmark as Futures Trading Accelerates on Exchange,* NGI, 27 October 2025, https://tinyurl.com/mh885f47.

4 Price benchmarking via pricing centres

Progress along the commodification pathway changes price discovery. Production, supply and transport of commodities are dynamic processes, with different qualities and grades sold in different places at different times. A reliable price benchmark links these dynamics and provides a unified reference point for price discovery.[19] The standardisation of contracts and addition of financial instruments creates lock-in effects for the pricing centres around which these contracts are traded. **This is because value in commodity markets is created where optionality to transform commodities across time, space and form is the greatest.[20] Market participants gravitate toward pricing their commodity at the location of highest optionality, thereby realising the greatest possible market value.**

A pricing centre is the physical location underlying the benchmark price at which transactions take place for a commodity of consistent quality and wide availability. The transparency introduced by a benchmark supports efficient resource allocation and reduces supply, price, liquidity, counterparty and regulatory risks for producers and buyers alike.[21] This is particularly important for risk-weighted capital allocation, as it provides standardised, transparent and liquid data points for quantifying the volatility and correlation of raw materials. Benchmarks also serve as a baseline for pricing related goods within the same category: commodities of inferior quality trade at a discount, those of superior quality at a premium. In the financialised market, they provide the physical delivery locations that underpin futures contracts.

Box 5

Pricing centres, price benchmarks and exchanges in commodity markets[22]

Modern price benchmarks emerged in the mid-1800s, beginning with a regional grain benchmark in Chicago and a global cotton benchmark spanning regional hubs in Alexandria, Liverpool and New Orleans. Progress in price discovery slowed in the 1930s and 1940s, impeded by protectionist trade measures and government supply management schemes, before resuming with global trade liberalisation in the 1950s and 1960s. Since then, commodification has continued across many products, as illustrated by the LNG example in Box 4 and the iron ore example in Box 8.

Historically, price benchmarks were established by commodity exchanges that were co-located with pricing centres in cities such as London or New York because physical cargo information needed to be transmitted quickly to the market. As information technology improved, exchanges became more geographically disconnected from pricing centres. Today, for example, copper, aluminium and nickel futures traded on the LME in London have their underlying physical cargo spread across 450 warehouses in 32 countries across Europe, Asia and the US.[23] Similarly, Europe's leading gas benchmark, the TTF, is centred on the Netherlands but is traded on exchanges in Leipzig (EEX), Atlanta (ICE) and Chicago (CME).

19. Joe Raia, *Back to the Future(s): the best commodities benchmarks are still physically settled,* Energy Connects, 23 May 2024, https://tinyurl.com/h422fhkz.
20. Trafigura, *Commodities Demystified: A Guide to Trading and the Global Supply Chain,* 2019, https://tinyurl.com/38t4tz4c.
21. The Payne Institute for Public Policy, *Critical Minerals: Markets Primer,* June 2025, https://payneinstitute.mines.edu/wp-content/uploads/sites/149/2025/06/Critical-Minerals-Markets-Primer.pdf, p. 39.
22. John Baffes and Peter Nagle, *Commodity Markets: Evolution, Challenges, and Policies,* World Bank, 2022, https://thedocs.worldbank.org/en/doc/b4ff84b2d5dc4d0963a5074102460cc1-0350012022/original/Commodity-Markets.pdf, pp. 82-88.
23. LME, LME warehouse network, https://tinyurl.com/yc2xk37u

New York, Chicago and London dominated global price benchmarking through the 1800s and 1900s, but from the 2000s faced growing competition from Singapore, Shanghai and Dalian as commodity trade flows shifted eastward — illustrating the importance of physical cargo throughput as a precondition for establishing a pricing centre.

Physical markets are the foundation for pricing centres

Commodification rarely occurs without an underlying physical market, whether for OTC, forward, spot or futures contracts.[24] For example, the Brent crude benchmark — which prices around 80% of international spot oil trade and 32% of all international oil trade — is traded out of London but references the UK and Norwegian North Sea as the underlying physical market.[25] Physical settlement in the trade of financialised, exchanged-based futures contracts has four essential elements:[26] **standardised contracts** with pre-specified quality, quantity, delivery windows and commercial terms; **a defined location** for **physical exchange**; physical settlement of transactions resulting in the making and taking of delivery, not merely a cash (financial) settlement; and **observable transactions** that provide sufficient transparency of prices, volumes and counterparties to generate price discovery.

Physical settlement of transactions is particularly important. In a financialised market, the spot price and futures price need to converge at the expiration of the futures contract. This is reinforced by physical settlement, which tethers futures positions to the physical market.[27] As a result, physical delivery at the hub makes it a pricing centre through the following functions:

- **Price discovery:** Markets aggregate dispersed information — supply conditions, demand expectations, inventory levels, logistics constraints, weather and policy changes — into a single price signal that benchmarks bilateral contracts, guides production and consumption decisions, and underpins financial derivatives.
- **Risk transfer and hedging:** Standardised contracts allow participants to transfer price, quality, timing, logistics and counterparty risks. In futures markets, buyers and sellers offset physical market price risk by taking opposite positions, transferring it to parties seeking price exposure — a process known as warehousing risk.
- **Inventory coordination:** Spot and forward price signals — the basis, contango and backwardation — guide decisions on how much inventory to hold at the hub versus consumption points, when to release it, and where to invest in storage and logistics.
- **Transaction cost reduction:** Standardisation lowers search, negotiation, due-diligence and enforcement costs by making it easier to find counterparties, eliminating contract negotiations, reducing verification and providing clear dispute resolution procedures.

24. ICE, *Global crude benchmarks: Brent sets the standard Part 2*, https://tinyurl.com/hd4pw6yh.
25. ICE, *Global crude benchmarks: Brent sets the standard Part 1,* https://www.ice.com/global-crude-benchmarks-Brent-sets-the-standard; ICE, *Global crude benchmarks: Brent sets the standard Part 2.*
26. Abaxx, *Back to the Future(s): The Best Commodities Benchmarks Are Still Physically-Settled,* https://tinyurl.com/546dm6xm; The Board of the International Organization of Securities Commissions, *The Impact of Storage and Delivery Infrastructure on Commodity Derivatives Market Pricing,* https://tinyurl.com/2ukysma5.
27. Seb Kennedy, *'Let's get physical!': Abaxx takes on JKM,* Energy flux, 7 Nov 2025, https://tinyurl.com/22we9hj3.

Together, these factors give financial markets a credible physical foundation. The relationship operates through the basis — the difference between the local physical price and the benchmark futures price. If the physical market is illiquid, opaque or manipulated, the basis becomes volatile and unpredictable, hedging effectiveness falls, financial prices decouple from physical fundamentals, and delivery squeezes become possible, undermining contract confidence. Physical liquidity precedes and enables financial liquidity, not the reverse. **Ports seeking to become market platforms must first establish robust physical trading before attempting to attract financial derivatives activity.**

The virtuous cycle of physical delivery markets

Pricing centre formation can be modelled as a coordination game in which each potential participant decides whether to join the hub or use alternatives such as bilateral contracts, different ports or vertical integration.[28] As more participants enter, each actor's incentive to participate grows, drawing in buyers, sellers, traders, storage providers and banks and creating a virtuous cycle of supply liquidity, improved logistics and better financing access. Liquidity concentrates in a few benchmark contracts precisely because of these self-reinforcing dynamics.[29] The virtuous cycle operates through three mechanisms.

Direct network effects benefit participants on the same side of the market: more buyers create tighter bid-ask spreads[30] for all buyers; more sellers deepen order books and reduce price impact for all sellers; together they lower search costs and increase the probability of finding a counterparty quickly.

Indirect network effects arise when more participants on one side of the market create value for and share risk with those on the other. Physical market participants transfer price risk to financial market participants who actively seek it. The roles of traders offer helpful examples. More traders means more liquidity, tighter spreads and lower hedging costs for producers and consumers, greater demand for storage services, and more robust observable prices to support risk-weighted bank financing. Financing itself becomes self-reinforcing: as banks extend credit in liquid, transparent markets with standardised contracts, financing enables inventory holding, inventory holding enables market-making, and market-making enhances liquidity.

Information network effects compound these dynamics. More transactions generate more data points and more reliable price signals. As off-exchange contracts index to hub prices, the hub becomes embedded in contractual infrastructure, creating lock-in and raising barriers to competing hubs. Financial derivatives referencing the hub further reinforce the underlying physical market.

Achieving this from nothing creates a chicken-and-egg problem: buyers will not come without sellers, sellers will not come without buyers, and neither will come without sufficient liquidity and infrastructure.[31] Without coordination, valuable markets may never form, as no single participant can profitably move first. Crossing the critical threshold of participation requires an external nudge — a coordination role that port authorities are well placed to fill through physical infrastructure provision, institutional frameworks, incentives to reach critical mass, and a credible market platform to build participant confidence.

28. Russell Cooper and Andrew John, Coordinating coordination failures in Keynesian models, *The Quarterly Journal of Economics,* 103(3), 441-463, 1988; Paul Milgrom, John Roberts, Rationalizability, Learning, and Equilibrium in Games with Strategic Complementarities, *Econometrica: Journal of the Econometric Society,* 1255-1277, 1990.
29. Craig Pirrong, *The Economics of Commodity Trading Firms.* Trafigura, 2011; William Silber, Innovation, competition, and new contract design in futures markets. *The Journal of Futures Markets, 1(2),* 123-155, 1981.
30. The commodity market bid-ask spread is the difference between the highest price a buyer is willing to pay (bid) and the lowest price a seller will accept (ask/offer). It serves as a key measure of market liquidity and transaction costs, where narrow spreads indicate high liquidity and wide spreads signal lower liquidity.
31. David Evans and Richard Schmalensee, *Failure to Launch: Critical Mass in Platform Businesses,* SSRN, 2010; Andrei Hagiu and Julian Wright, Multi-sided platforms. *International Journal of Industrial Organization,* 43, 162-174, 2015.

Box 6

China's pursuit of commodity pricing centre status

Since the 1990s, China has established several commodity exchanges, including the Dalian Commodity Exchange (DCE), Zhengzhou Commodity Exchange (ZCE) and the Shanghai Futures Exchange (SHFE). These have become prominent pricing hubs in select commodities, and Chinese officials have signalled ambitions to go further — notably by developing futures for commodities such as crude oil on Chinese exchanges to strengthen China's pricing power in global markets.[32]

Even in the crude oil market, which has well-established global benchmarks in Brent and WTI, the China-based Shanghai International Energy Exchange (INE) launched a crude oil futures contract in 2018 that has traded continuously since. The link to statecraft is direct: when the US sanctioned the Chinese port of Yangshan in 2025 for handling sanctioned Iranian oil, the INE contract experienced significant volatility, since Yangshan is one of few locations designated for physical delivery of both INE and SHFE futures contracts.[33]

A further geoeconomic dimension is currency. Chinese futures, including the INE crude oil contract, are denominated in renminbi (RMB), whereas most global exchanges trade in US dollars (USD). While the USD remains dominant in trade finance — accounting for around 80% of all transactions — the RMB is the second most used currency at around 9%, ahead of the euro at around 6%.[34] Trading in RMB reduces USD currency risk for Chinese buyers and sellers. **The lesson for Europe is that commodity trading, and European futures contracts in particular, can promote the use of the euro in international transactions.**

While it is not the primary objective, commodification of raw materials in Rotterdam offers an opportunity to lock them into euro-denominated transactions, particularly futures contracts. Since the majority of global commodity futures are priced in USD or RMB, additional pricing of commodities in euros can satisfy the growing European investor demand for euro-denominated alternative asset classes that avoid exposure to foreign currency risk, particularly the USD.[35] This can also act as an incentive to attract financial market participants such as commercial banks and other investors such as pension funds in the commodification process.

32. Michal Meidan and Adi Imsirovic, *The Shanghai Oil Futures Contract and the Oil Demand Shock,* The Oxford Institute for Energy Studies, July 2020, https://tinyurl.com/3d5c9cv7.
33. Jeslyn Lerh, Chem Aizhu and Siyi Liu, *Volatility surges on China oil futures after US sanctions Yangshan port,* Reuters, 28 August 2025, https://tinyurl.com/wj25puzp.
34. Diana Choyleva, *Why China's renminbi push matters even if it never rivals the dollar,* Financial Times, 13 March 2026, https://www.ft.com/content/77f8cc0d-7aef-46a2-8460-67a05760a41c.
35. Philip R. Lane, *The euro in a changing world,* 9 January 2026, ECB, https://tinyurl.com/2msem2xp.

5 Ports as pricing centres

Ports have historically been seen primarily as logistics nodes — locations where bulk cargo is transferred between transport modes, stored temporarily and undergoes basic processing — with performance measured through throughput, vessel handling efficiency, capacity utilisation and hinterland connectivity. This view treats ports as passive infrastructure providers competing on cost and speed. Certain ports have transcended their logistics function to become reference points for pricing and contractual terms: Rotterdam for oil products in Europe; ARA for coal, fuel oil and petroleum products; Santos/Paranaguá for soybean pricing in South America; Singapore for bunker fuel, petrochemicals and iron ore in Asia; and Houston for US crude oil and LNG exports. These ports generate price signals that ripple through global markets, reflecting their position as locations of highest regional optionality.

Box 7

The case of New York Coffee[36]

Coffee producers, roasters and brand owners have traded coffee futures on exchanges in New York and London for over 100 years to manage price risk. Exchange-traded contracts specify quality, origin and delivery location. The ICE Coffee C Futures contract, for example, allows physical settlement in New York, Virginia, New Orleans, Houston, Miami, Bremen/Hamburg, Antwerp and Barcelona.[37]

A coffee bean originating in Mexico or Kenya might be hedged by an Amsterdam roaster — seeking protection against a price rise — and a Zurich trader seeking protection against a price fall, with ICE as counterparty to both. In the physical market, the trader may have bought the coffee FOB in Mombasa and sold it to the Amsterdam roaster, probably at a premium, since Amsterdam is not a futures delivery location. Both parties are hedged at ICE, exposed only to the differential between their original futures price and the spot price at delivery. The price risk transfer occurred in New York, yet the coffee itself never went there..

The C Futures are a legacy of New York's role as the global coffee pricing centre in the late 1800s to early 1900s, when the city received nearly 90% of US coffee imports.[38] **Today New York receives only a minor share of physical deliveries under the contract, but the lasting gain has been its entrenchment as a hub for coffee traders, brokers and investors — and the reinforcement of the US dollar in international trade.**

These value streams depend not on owning the commodities or bearing price risk, but on providing the institutional and informational infrastructure that enables others to trade efficiently. This requires addressing coordination problems and solving the chicken-and-egg problem of attracting initial participation.[39] In doing so, **the port authority's role shifts from operator to orchestrator.** This is essential for port authorities that want to move from pure logistics competition with other ports into serving as a market platform.

36. Harold de Boer, *Commodity futures as global benchmarks,* Transtrend, June 2025, https://www.transtrend.nl/en/insights/commodity-futures-benchmarks/.
37. ICE, *Coffee C® Futures*, https://www.ice.com/products/15/Coffee-C-Futures.
38. Brooklyn Waterfront History, *Where Coffee Was King,* https://tinyurl.com/ynmp434b.
39. These insights are grounded in the perspective of ports-as-market-platforms through the lens of platform economics, drawing on theoretical frameworks developed by Rochet & Tirole (2003, 2006); Parker, Van Alstyne & Choudary (2016); and Evans & Schmalensee (2016).

Box 8

How Singapore became a pricing centre for iron ore, but failed for LNG[40]

Singapore produces no iron ore and historically was not a major throughput hub for it. Yet through a combination of government initiative and favourable circumstances, it became the world's main iron ore price benchmark within a decade. Three factors drove this: Singapore's location between key supply (Australia) and demand (China) markets, its established ties to major Chinese industrial consumers, and its ability to capitalise on severe iron ore market imbalances in 2008–2010.

PRA Platts launched the world's first daily iron ore price assessment, IODEX, in Singapore in 2008. The Singapore Exchange (SGX) began clearing iron ore derivatives in 2009, deepening liquidity. The government's Global Trader Programme — offering tax incentives for firms locating in Singapore — attracted major consumers such as Chinese steelmakers and global miners including BHP Billiton, Vale, Rio Tinto, Glencore and Anglo American to establish trading operations there.[41] This concentration of key market participants brought others with it, such as brokers and consultancies serving the market in the right time zone. Chinese exchanges have since sought to challenge SGX's dominance but have not displaced it.

Singapore's iron ore success was not replicated in LNG.[42] It lacked an underlying physical market and faced strong competition from the established JKM benchmark for Asia, resulting in high basis risk between the Sling price and delivery in Northeast Asia, and limited arbitrage opportunity in Singapore. **The lesson for Europe is that even well-coordinated institutional efforts cannot substitute the need of an underlying physical market.**

40. Julien Hall, *Iron awe: How Singapore became the world's main trading hub in just 10 years,* S&P Global, 27 June 2018, https://tinyurl.com/bdef76ha.
41. Enterprise Singapore, *Global Trader Programme,* https://tinyurl.com/2r7z2wet.
42. Jessica Jaganathan, *Singapore to stop 'Sling' LNG indices, sheds hopes of main price hub,* Reuters, 30 July 2019, https://www.reuters.com/article/business/singapore-to-stop-sling-lng-indices-sheds-hopes-of-main-price-hub.

6 How to develop a port into a pricing centre

A pricing centre is not created entirely by design. As the Singapore example in Box 8 illustrates, it must leverage advantages such as location, volume, timing and institutional capacity. That said, correctly identifying and supporting the right markets can catalyse a port's transition to a pricing centre. Successful positioning begins with a diagnostic analysis across four parameters:

- **Volume and flow analysis:** Identifying which commodities have substantial existing flows, which commodities are anticipated to grow in throughput, and determining how much volume is contractually locked in versus available or convertible for spot trading.
- **Competitive positioning:** Assessing current price reference points and how entrenched they are; how the hub can differentiate itself from competitors on grade, origin or quality; and what capabilities it can offer in storage, transportation, blending and processing.
- **Stakeholder mapping:** Identifying key market participants that need to be engaged by the port authority — producers, consumers, traders, banks, storage operators, brokers, insurers and logistics providers — and determining which would benefit from greater market transparency and which might resist it. The latter can impact the process, as shown in Box 9. The mapping includes an assessment of whether the hub can secure offtake commitments from suppliers and buy-in from commodity traders to establish initial liquidity.
- **Institutional assessment:** Evaluating regulatory barriers to market formation, the willingness of banks and financiers to fund production assets and commodity inventories, and the political will at national government level to provide political, financial and regulatory backing for the initiative.

Box 9

Incumbent resistance to the commodification of rapeseed oil contracts

Transparent price discovery does not benefit all market participants. Those capturing transformation arbitrage in an opaque market, particularly asset owners, have an incentive to preserve that opacity. When the Paris-based futures exchange MATIF (now Euronext Paris) sought to launch a rapeseed oil contract in the 1990s, it approached the major agricultural traders for support. These traders, however, held the transformation arbitrage as the parties buying rapeseed and crushing it into oil; a rapeseed oil contract would have exposed their crush margins. They instead backed a rapeseed contract that served their own interests and those of their suppliers. This contract still trades on Euronext today. **The lesson here is that resistance to price transparency has to be factored into the commodification process.**

This assessment should identify commodities with high network-effect potential and a realistic path to critical mass. This implies sufficient existing volume, high fungibility, absent or weak incumbents benchmarks, and a feasible public-private coalition supported by the necessary legal, regulatory and financial infrastructure. Concentrated effort on one or few commodities creates more value than diffuse effort across many, and success in one creates demonstration effects and credibility that facilitate expansion to others.

The assessment should consider the willingness and ability of the port authority and partner institutions to address the chicken-and-egg problem through early-stage subsidisation. Mechanisms may include liquidity-seeding via reduced port fees for trades executed under the standardised hub contract, subject to minimum participation thresholds to ensure critical mass is reached; minimum volume commitments secured directly

from major traders or end-users in exchange for preferential access or fee discounts; and subsidised storage costs for operators that commit to transparent inventory reporting. The port authority needs to collect and share (anonymised) price and trade data, including liquidity metrics, spreads, depth, participation breadth and price informativeness, alongside traditional volume metrics. Cumulatively, these measures will activate an initial pricing centre function and provide the information infrastructure needed to unlock network effects. The goal is a temporary strategic intervention to reach the tipping point, after which network effects sustain participation without further support.

Box 10

Dutch and German initiatives to stimulate a hydrogen market in Europe[43]

The examples of HyXchange and H2Global show how targeted interventions can catalyse emerging commodity supply chains and overcome chicken-and-egg problems.

HyXchange is a Dutch market creation initiative backed by Dutch port authorities (including the Port of Rotterdam), Gasunie and other market participants. It aims to develop the conditions for a hydrogen exchange by: supporting the creation of accessible hydrogen transport infrastructure ("backbone"); sourcing diverse hydrogen supplies; building a trading platform to enhance transparency, pool liquidity and reduce transaction costs; standardising hydrogen certificates and aligning them with EU regulations; stimulating a hydrogen spot market; and developing the HYCLICX hydrogen price indicator.

H2Global is a German government initiative led by the H2Global Foundation. It operates as a double-auction instrument, using public capital and primarily contracts for difference (CfDs) to bridge the price gap between buyers and sellers — in effect addressing the chicken-and-egg problem in underdeveloped commodity markets. Its subsidiary Hintco acts as a physical trading intermediary, concluding long-term offtake agreements to provide supplier certainty and short-term sales agreements to provide buyer flexibility. Hintco uses the Leipzig-based European Energy Exchange (EEX) to trade gaseous hydrogen and hydrogen derivatives.[44]

Contract design can make or break a pricing centre. Though contract design is outside of the port authority's mandate, it should monitor aforementioned price and trade data for early signals of trading volatility, which is needed for successful contract launches. Contracts codify the trade-off between standardisation and flexibility, with key design features including quality specifications (e.g. moisture content in agricultural products), lot sizes (e.g. metric tons of metals), delivery windows (e.g. five to seven days), merchant usability and clear formulas for deviations from the standard on quality, timing and location. Many contracts fail not because the underlying vision was flawed, but because terms were too rigid or delivery windows too narrow for actual market requirements. This is illustrated in Box 11.

43. HyXchange, *About HyXchange*, https://hyxchange.org/about/; H2Global Foundation, *Shaping the global energy transition*, https://h2-global.org/.
44. Hintco, *How it works*, https://hintco.eu/how-it-works/.

Box 11

Good contract design and the failure of ARA crude oil futures in the 1980s[45]

The International Petroleum Exchange (IPE, since acquired by ICE) was founded in London in 1980 to trade gas oil and crude oil futures. Seeking to replicate NYMEX's success with the West Texas Intermediate (WTI) crude oil futures contract — launched in March 1983 with pipeline delivery in Cushing, Oklahoma — IPE followed in November 1983 with the first Brent crude futures contract, designed around in-tank delivery in Rotterdam. Rotterdam had by that time developed into a very deep and liquid spot market.

This contract failed on two counts. Its minimum lot size of 500,000 barrels was too large for most market participants, and the in-tank delivery specification was too restrictive, creating access risks due to limited storage availability in Rotterdam. After several attempts to launch a workable ARA contract, IPE succeeded in 1988 with what is now the ICE Brent Futures contract, which trades at a lot size of 1,000 barrels.[46] **This example shows the necessity of appropriate contract design for the market to eventually adopt the contract. Geographical delineation is key for setting the physical settlement criteria.**

Why some ports become pricing centres and others do not

The following conditions are necessary to become a pricing centre, but far from sufficient:[47]

- **Physical volume:** Substantial flows are needed, but high volume alone does not guarantee price discovery. Many high-volume container ports — Los Angeles/Long Beach and Piraeus among them — never became pricing centres, while others, such as New York and London, the pricing centre functionality actually pre-dates containerisation.
- **Variety of buyers and sellers:** A reliable benchmark requires liquidity across many different buyers and sellers to be truly representative of the market.
- **Storage capacity:** The ability to hold inventory is essential, but capacity alone does not guarantee its use for market-making.
- **Connectivity:** Strong logistics links to the hinterland and global shipping routes support liquidity in shipping markets and enable the break-bulking of larger cargoes.
- **Participation of commodity traders:** Traders enable commodity flows by providing liquidity and warehouse risk. Benchmark expansion often depends on their participation.
- **Broad market acceptance:** Wide participation across physical and financial markets makes a hub more attractive for hedging and risk capital deployment, and the resulting depth of participation minimises price slippage on entry and exit.

These conditions create potential but do not guarantee market formation. The differentiating factors are institutional and governance-related. Even where fundamentals are favourable, coordination failures — stemming primarily from geographic fragmentation, contract fragmentation and incumbent resistance — can prevent a pricing centre from emerging.

45. Hossein Razavi, *The New Era of Petroleum Trading: Spot Oil, Spot-Related Contracts, and Futures Markets,* World Bank, https://documents1.worldbank.org/curated/en/603911468739482147/pdf/multi-page.pdf pp. 66-69; David Peniket, *Brent and the international petroleum exchange in Adi Imsirovic,* Brent Crude Oil, 2023, pp. 91-109.
46. ICE, *Minimum Volume Thresholds for Block Trades [Attachment 2 to Circular 17/230],* 2017 https://www.ice.com/publicdocs/circulars/17230%20attach%202.pdf.
47. ICE, *Global crude benchmarks: Brent sets the standard Part 2.*

Geographic fragmentation occurs when multiple ports in a region compete for benchmark status, splitting liquidity and preventing any single hub from achieving dominance. While the EU rightly stimulates competition within the bloc, it is important that the bloc has domestic champions that are globally competitive. Contract fragmentation has a similar effect: too many specifications across quality, lot size and delivery terms disperses liquidity across multiple instruments. Incumbent resistance arises where established market participants derive competitive advantage from opacity and bilateral relationships — large traders profiting from information asymmetries and wide bid-ask spreads, or integrated companies with processing assets such as refineries, power plants and crushing facilities seeking to protect margins between feedstocks and outputs, as exemplified in Box 9. Transparent markets with tight spreads erode these rents.

Box 12

The rise and fall of a pricing centre: palm oil in Rotterdam

Rotterdam became a pricing centre for palm oil in the 1980s. This was enabled by its function as an optionality hub: there is tank storage (e.g. Vopak) and palm oil refineries (e.g. Wilmar) that refine it for food, biofuel (for which Rotterdam is also a hub) and oleochemicals for distribution into the industrial European hinterland. However, shifting consumer habits and the introduction of the EU Deforestation Regulation (EUDR), which targets palm oil, eroded European demand. In response, PRA Platts discontinued its formal price assessments for palm oil deliveries CIF Rotterdam in 2025, having published them since 2019.[48] By segmenting the EU palm oil market from global trade, the EUDR effectively de-commodified palm oil in Rotterdam, reverting the market to opaque OTC transactions. This primarily affects end consumers — such as consumer goods producers purchasing refined palm oil — who now face reduced price transparency. Price discovery has reverted to the Malaysian Bursa Malaysia Derivatives (BMD) exchange and FOB quotes at Malaysian and Indonesian ports, with premia added for Rotterdam delivery. **This case shows that commodities can also de-commodify and pricing centres can lose their signalling function.**

The palm oil example in Box 12 is instructive to the case of bunker fuels in Rotterdam. The uneven application of the EU's revised Renewable Energy Directive (RED III) by Belgium and The Netherlands has created structural differences in bunker fuel prices due to differences in renewable fuel blending requirements. In the first quarter of 2026 this resulted in Antwerp trading 52% more bunker fuel volume than Rotterdam, even though Antwerp usually trades less than Rotterdam.[49] Changes in bunkering costs will likely impact cargo throughput, as shipping companies will opt to dock in Antwerp, rather than Rotterdam. This may not only reduce the number of port calls in Rotterdam, but also weaken its pricing centre function for bunker fuels. While the renewable fuels market in Rotterdam is rapidly expanding, this case also shows that 'old' commodities can not be disregarded while the new supply chains are being established, especially when bunker fuel and biofuel pricing is interrelated.

48. S&P Global, *Platts discontinues CPO and CPKO CIF Rotterdam assessments effective May 6*, 6 May 2025, https://tinyurl.com/3db78n35;S&P Global, *Platts launches CIF Rotterdam Crude Palm Oil, Crude Palm Kernel Oil assessments Nov 1*, 1 November 2019, https://tinyurl.com/ysbk8vya.
49. Argus, *Antwerp bunker sales overtake Rotterdam: Correction*, 23 April 2026, https://tinyurl.com/358sy5ts.

Table 2. *Energy and metal derivatives benchmarked to prices discovered in the Rotterdam/ARA region.*

Commodity	Benchmark	Financial derivative	Contract settlement
LNG	-	Abaxx LNG NWE Futures	Physical
Thermal coal	Argus/McCloskey API2 (ARA) coal index	ICE Rotterdam Coal Futures (API2)	Cash
Gasoline	Eurobob gasoline 10 ppm FOB ARA	ICE Eurobob gasoline futures	Cash
	Premium unleaded gasoline 10 ppm FOB Rotterdam barges	ICE Premium Unleaded Gasoline FOB Rotterdam futures	Cash
Diesel / Gasoil	Diesel 10 ppm FOB ARA barges	ICE Low Sulfur Gasoil Futures	Physical
	Gasoil 0.1% FOB ARA barges	ARA differential swaps vs ICE gasoil	Cash
	Gasoil 50 ppm FOB Rotterdam		
Jet fuel	Jet Kerosene FOB Rotterdam	Jet fuel swaps Spreads vs ICE gasoil	Cash Cash
	Jet CIF NWE cargo		
Naphta	Naphtha CIF Northwest Europe	ICE Naphtha futures Naphtha vs Brent crack spreads	Cash Cash
Propane / LPG	Propane CIF ARA	LPG swaps and forward curves referenced to Propane ARA	Cash
Fuel oil and marine fuels	Fuel Oil 3.5% FOB Rotterdam barges	ICE Fuel Oil FOB Rotterdam futures	Cash
	Marine Fuel 0.5% FOB Rotterdam barges	ICE Marine Fuel 0.5% Rotterdam futures	Cash
	Marine Gas Oil delivered Rotterdam	Swaps vs ICE gasoil	Cash
Biofuels	FAME 0 biodiesel FOB Rotterdam	ICE futures on Argus biodiesel FOB Rotterdam vs gasoil spreads	Cash
	RME biodiesel FOB Rotterdam		
	Platts UCOME FOB ARA assessment	Swaps and forward curves used in renewable diesel supply chains	Cash
Aluminium	Fastmarkets' Aluminium P1020A premium, in-whs dp Rotterdam	LME Aluminium Premium Duty Paid European (Fastmarkets MB)	Cash
Cobalt	Fastmarkets Cobalt Standard Grade In-Warehouse Rotterdam	ICE Cobalt Standard Grade in-WHS Rotterdam Future	Cash
Copper	Fastmarkets Copper grade A cathode premium, CIF Rotterdam	LME Grade A copper	Physical
Lithium	-	Abaxx Lithium Carbonate Rotterdam Futures	Physical

Market hubs tend to form in jurisdictions with strong rule of law, independent judiciaries, and transparent governance.[50] **Rotterdam's success as a commodity hub is inseparable from the institutional quality of The Netherlands and the EU** — a favourable backdrop against which the port authority's most valuable asset is not effective management of the port, but its credibility as a neutral, competent and fair arbiter. Yet this credibility delivers little value if the port cannot overcome geographic and contractual fragmentation and incumbent resistance.

As the ecosystem orchestrator, the port authority needs to use strategic coupling — its relational capacity to link its assets with global network demand, using physical assets, institutional leverage and narratives. For example, it already does this by providing terminal lease concessions to terminal operating companies, offering container free storage times to shipping lines, or by informing the national government on the importance of the port's functionality. In the geopolitically fraught commodity markets that are critical to the EU's prosperity, it can strategically couple the physical and financial commodity market participants to support price discovery and price risk management mechanisms.

Box 13

How strategic coupling supports decarbonisation

In 2023, the EEX launched HYDRIX, a weekly green hydrogen price index based on voluntary market participant reporting, designed to improve price transparency in the emerging green hydrogen market. In 2025 HYDRIX became the reference price for Carbon Contracts of Difference (CCfD) offered by the German Federal Ministry of Economic Affairs and Climate Action (BMWK).[51] These CCfDs reduce the carbon price risk faced by industries investing in low-carbon technologies by covering the gap between a reference CO_2 price — such as the EU Emissions Trading System (EU ETS) price — and a guaranteed strike price, making low-carbon technologies more competitive relative to carbon-intensive alternatives when the EU ETS price falls.[52] As noted in Box 10, EEX also serves as the trading platform for hydrogen contracts under Germany's H2Global initiative.[53] **Together, these examples illustrate how government policy and market-based pricing instruments can be combined to build an ecosystem that attracts supply.**

50. Douglass North, *Institutions, Institutional Change and Economic Performance,* Cambridge University Press, 1990; Avner Greif, Institutions and the Path to the Modern Economy: Lessons from Medieval Trade, Cambridge University Press; Daron Acemoglu and James A. Robinson, Why Nations Fail: The Origins of Power, Prosperity, and Poverty, Crown Business, 2012.
51. EEX, *EEX's HYDRIX selected by BMWK for Carbon Contracts for Difference*, 7 May 2025, https://tinyurl.com/bd3rmxbv.
52. Florence School of Regulation, *Carbon contracts for difference*, 27 June 2025, https://fsr.eui.eu/carbon-contracts-for-difference/.
53. EEX, *A hydrogen market for decarbonising the economy,* https://www.eex.com/en/markets/hydrogen#29899.

7 Opportunities for further commodification in Rotterdam

Rotterdam may be able to play a pricing centre function for the following commodities: LNG, ammonia, biofuels, lithium (carbonate), manganese and nickel (sulphate). This is assessed based on recent and anticipated demand increases in the EU, coupled with positive market developments and price discovery in Rotterdam. Table 3 provides a brief summary of these.

Table 3. *Proposed list of opportune commodities for price benchmarking in Rotterdam*

Commodity	Commodification phase	Rotterdam's pricing centre function	Relevant recent market developments
LNG	Spot / financialised market (2/3)	A TTF physical delivery hub	2024: Abaxx launched an LNG futures contract for northwest Europe
Ammonia	Long-term offtake (1)	European ammonia pricing hub	• May 2026: MoU signed between NLHydrogen and Gulf Energy Catalyst to develop Rotterdam - US Gulf Coast hydrogen trade. • April 2025: Argus launched EU low-carbon ammonia benchmark for deliveries in ARA; Platts has one since 2022. • April 2026: Platts launched a hydrogen price assessment in northwest Europe. • Experience of HyXchange.
Biofuels	Long-term offtake / spot market (1/2)	European biofuels pricing hub	• March 2026: Platts launched B30 Biobunker Advanced FAME assessments for delivery in Rotterdam. • Dutch implementation of REDIII mandates.
Battery-grade lithium carbonate	Spot / financialised market (2/3)	European lithium carbonate pricing hub	• 2025: Abaxx launched a lithium carbonate futures contract that is physically settled in Rotterdam. • 2024: SK tes opened battery recycling plant in Rotterdam
Manganese	Long-term offtake (1)	European pricing hub for electrolytic manganese flake	• Upcoming opening of Liminal by WMC battery recycling plant in Rotterdam • 2025: Port of Rotterdam entered into a service agreement with the Port of Lüderitz in Namibia; exploring potential for manganese export from there.
Battery-grade nickel sulphate	Spot / financialised market (2/3)	Price discovery for LME nickel (delivered in Rotterdam) and nickel sulphate	• 2025: Abaxx launched the world's first nickel sulphate futures contract that is physically settled in Singapore. • 2023: Platts and Fastmarkets launched price assessments for nickel sulphate in Rotterdam.

Mobilising digital platforms to advance commodification

Kickstarting a virtuous cycle in the physical market requires network effects, particularly in information. Reducing information asymmetries is central to a pricing centre's function, making the effective transfer of information critical to its development, especially when physical and financial market participants are not aligned. Therefore, the port authority's effort can be enabled by digital service providers such as exchanges, market platforms and other digital services. Different actors and digital platforms will suit different stages of market maturity and commodity characteristics. Box 14 provides a non-exhaustive list of platforms that may be relevant for a commodification process.

Box 14

Digital platforms as the enabler of price discovery

Liquidity is the key to commodification, but once minimal viable liquidity is established, a digital platform needs to provide the necessary trading infrastructure. The EU already has a well established digital infrastructure and knowhow for commodification and price discovery. This includes both general and niche platforms. A non-exhaustive list includes:

- **Exchanges and clearing houses: LME** (London, UK, but with approved warehouses in the EU), **EEX** (Leipzig, Germany), **Euronext** (Netherlands/France) and **Abaxx Exchange** (Singapore-based, but with physical delivery in the EU), **ICE** (Atlanta, US)
- **Market development initiatives: H2Global** (hydrogen; Germany) and **HyXchange** (hydrogen; Netherlands)
- **Market pricing, trading and matchmaking platforms: Tradefox** (scrap metal prices; Netherlands), **Vesper** (agri-food commodities and food ingredients; Netherlands), **Metalshub** (metals and minerals; Germany; being expanded for REEs and other CRMs in cooperation with EIT Raw Materials), **Softmetal** (metal alloys; Switzerland), **Excess Materials Exchange** (waste material, including scrap metal; Netherlands), **Integr8** Fuels (bunker fuels, including Rotterdam; Singapore)
- **Other enabling platforms: VertiCer** (guarantees of origin; Netherlands), **FuelFWD** (renewable fuel compliance; Netherlands), **Komgo** (trade finance SaaS; Switzerland), **Vortexa** (energy cargo data; UK), **Kpler** (energy cargo data; Belgium), **Minespider** (metals product passports; Germany) and **MineHub** (metals post-trade execution; Canada).

The suggested materials in Table 3 and initiatives listed in Box 14 offer a starting point for the port authority to assess which of these commodities warrant a detailed assessment based on the framework presented in Chapter 6. This should inform the port authority's strategic coupling efforts with physical and financial market participants, as well as national and EU stakeholders to position Rotterdam as the European pricing centre of key commodities.

8 Conclusion

The geoeconomics of pricing centres can be illustrated by the prominent example of crude oil price discovery shifting in response to the 1973 oil crisis. The backdrop to this was the ability of companies like BP to maintain off-take agreements from Persian Gulf producers after the nationalisation of oil companies starting in the 1950s. In the run up to the 1973 oil crisis, the global oil supply chains were dominated by European and American oil majors who refined the oil in key hubs in the ARA, Pennsylvania and the US Gulf Coast. However, the Arab nations under the Organization for Petroleum Exporting Countries (OPEC) set the prices because of their dominant supply position.

In response to the 1973 crisis, four things happened. First, governments and oil majors began to stockpile oil through purchases on the spot market, particularly close to Western refinery clusters such as ARA. As arbitrage emerged between the Rotterdam spot market and the OPEC price regime, new market participants, commodity traders such as Marc Rich & Co, Transoil and Vitol, began to enter the trade. Second, the crisis prompted the exploitation of North Sea oil as an alternative to supplies from the Persian Gulf. Third, following the 1975 US crude oil export ban, domestic market participants responded by creating mechanisms for more efficient oil product delivery across the country. Fourth, with oil majors swapping supply risk for price risk in a volatile spot market, a financialised market emerged, spurred by the interest from Wall Street financiers such as Morgan Stanley to participate in the market. Locally embedded participants active on the 'Rotterdam (spot) market', also sought to launch financial derivatives, but eventually lost out to the initiatives that emerged out of London (IPE) and New York (NYMEX). The IPE was set up in 1980 to price the North Sea oil without OPEC's influence, on the back of the second supply disruption from the Middle East in the 1970s, this time caused by the 1979 revolution in Iran.

The convergence of these developments led to the creation of exchanges in New York and London that traded against the US benchmark, the WTI, and the North Sea benchmark, Brent, respectively. As the financial market expanded, it provided an alternative asset class via the WTI-Brent spread. The spread is effectively the transportation cost difference between the US domestic crude market and the northwest European market facilitating the trans-Atlantic trade in energy molecules over the last 50 years. This transition drove the Western dominance in oil market price setting, arguably supporting the US dollar as the world's currency reserve and took the initiative away from the OPEC cartel. Up to today, the WTI (CME) and Brent (ICE) contracts, and the spread between the two, are the most traded contracts.

In competitive commodity markets, supply and demand imbalances incentivise opportunistic participants to restore balance in the market. However, the 1970s oil example shows how the interplay between private and government action structurally shifted the balance of power in the market. This competition is once again underway; this time between the US and China. For the EU not to be left disadvantaged, it has to identify and secure opportunities to physically locate and price commodities in Europe.

For European efforts to meaningfully influence commodification and price discovery, they need to enable Rotterdam to be the globally-competitive European pricing centre, stimulate physical liquidity there, and create an enabling institutional environment. Similar to how the stockpiling of oil in response to the 1973 crisis helped turn Rotterdam into an oil pricing hub, stockpiling of EU CRMs in (or close to) Rotterdam may enable it to become a pricing hub for more CRMs. The recommendations at the start of the paper provide a tangible way towards these objectives.

References

"A Hydrogen Market for Decarbonising the Economy." Available from https://www.eex.com/en/markets/hydrogen#29899.

Abaxx. *Back to the Future(s): The Best Commodities Benchmarks Are Still Physically-Settled.* 2023. Available from https://lithium.org/wp-content/uploads/2024/02/Back-to-the-Future-The-Best-Commodities-Benchmarks-Are-Still-Physically-Settled.pdf.

"About HyXchange." Available from https://hyxchange.org/about/.

Acemoglu D., and J. A. Robinson. *Why Nations Fail: The Origins of Power, Prosperity, and Poverty.* Crown Business, 2012.

Aerts, N., T. Bohn, S. Creemers, et al. *Nederlandse afhankelijkheid van kritieke materialen.* CBS, 2025. Available from https://www.cbs.nl/nl-nl/longread/rapportages/2025/nederlandse-afhankelijkheid-van-kritieke-materialen/samenvatting.

Argus, *Antwerp bunker sales overtake Rotterdam: Correction*, 23 April 2026, https://www.argusmedia.com/en/news-and-insights/latest-market-news/2818147-antwerp-bunker-sales-overtake-rotterdam-correction.

"Argus Rare Earths Analytics Service." Available from https://www.argusmedia.com/en/solutions/products/argus-rare-earths-analytics.

Baffes, J., and P. Nagle, *Commodity Markets: Evolution, Challenges, and Policies.* World Bank, 2022. Available from https://thedocs.worldbank.org/en/doc/b4ff84b2d5dc4d0963a5074102460cc1-0350012022/original/Commodity-Markets.pdf, pp. 82-88.

Blakemore, R., and A. Harmon, "US Critical Minerals Policy Goes Collaborative with FORGE." Atlantic Council, 12 February 2026. Available from https://www.atlanticcouncil.org/dispatches/us-critical-minerals-policy-goes-collaborative-with-forge/.

"Carbon Contracts for Difference." Florence School of Regulation, 27 June 2025. Available from https://fsr.eui.eu/carbon-contracts-for-difference/.

Choyleva, D., "Why China's Renminbi Push Matters Even if it Never Rivals the Dollar." *Financial Times*, 13 March 2026. Available from https://www.ft.com/content/77f8cc0d-7aef-46a2-8460-67a05760a41c.

Cocklin, J., "Abaxx Sees Possibility for Global LNG Benchmark as Futures Trading Accelerates on Exchange." NGI, 27 October 2025. Available from https://naturalgasintel.com/news/abaxx-sees-possibility-for-global-lng-benchmark-as-futures-trading-accelerates-on-exchange/.

"Coffee C® Futures." Available from https://www.ice.com/products/15/Coffee-C-Futures.

"Commodities - Commodity Derivatives - MATIF." Available from https://live.euronext.com/en/products/commodities.

Cooper, R., and John., A., "Coordinating Coordination Failures in Keynesian Models." *Quarterly Journal of Economics 103*, no. 3 (1988): 441-463.

De Boer, H., "Commodity Futures as Global Benchmarks." Transtrend, June 2025. Available from https://www.transtrend.nl/en/insights/commodity-futures-benchmarks/.

"EEX's HYDRIX Selected by BMWK for Carbon Contracts for Difference." EEX, 7 May 2025. Available from https://www.eex.com/fileadmin/Global/News/EEX/EEX_Press_Release/2025/20250430_PM_EEX_HYDRIX_BMWK_KSV_FINAL.pdf.

Evans, D. S., and R. Schmalensee, "Failure to Launch: Critical Mass in Platform Businesses." *Review of Network Economics 9*, no. 4 (2010).

Evans D. S., and R. Schmalensee, Matchmakers: *The New Economics of Multisided Platforms*. Harvard Business Review Press, 2016.

Fastmarkets MB. *Rare Earths: Methodology and Price Specifications.* August 2025. Available from https://www.fastmarkets.com/uploads/2025/09/fm-mb-rare-earths.pdf.

"Global Crude Benchmarks: Brent Sets the Standard Part 1." Available from https://www.ice.com/global-crude-benchmarks-Brent-sets-the-standard.

"Global Crude Benchmarks: Brent Sets the Standard Part 2." Available from https://www.ice.com/why-the-world-needs-benchmarks-and-characteristics-of-benchmarks.

"Global Trader Programme." Available from https://www.enterprisesg.gov.sg/financial-support/global-trader-programme.

Greif, A., *Institutions and the Path to the Modern Economy: Lessons from Medieval Trade*. Cambridge University Press, 2006.

Hagiu, A., and J. Wright, "Multi-Sided Platforms." *International Journal of Industrial Organization* 43 (2015): 162-174.

Hall, J., "Iron Awe: How Singapore Became the World's Main Trading Hub in Just 10 Years." *S&P Global*, 27 June 2018. Available from https://www.spglobal.com/energy/en/news-research/blog/metals/062718-iron-awe-how-singapore-became-the-worlds-main-trading-hub-in-just-10-years.

Home, A., "West Needs its Own Pricing to Escape China's Rare Earths Grip." *Reuters*, 20 February 2026. Available from https://www.reuters.com/markets/commodities/west-needs-its-own-pricing-escape-chinas-rare-earths-grip-2026-02-20/.

"How It Works." Available from https://hintco.eu/how-it-works/.

Jaganathan, J., "Singapore to Stop 'Sling' LNG Indices, Sheds Hopes of Main Price Hub." *Reuters*, 30 July 2019. Available from https://www.reuters.com/article/business/singapore-to-stop-sling-lng-indices-sheds-hopes-of-main-price-hub.

Kapul, J., "Oil's Wild Ride: Crude Drops 10% after 30% Surge as Trump Signals Conflict May End." *Seeking Alpha*, 9 March 2026. Available from https://seekingalpha.com/news/4562436-oils-wild-ride-crude-drops-10-after-30-surge-as-trump-signals-conflict-may-end.

Kennedy, S., *'Let's get physical!': Abaxx takes on JKM*, Energy flux, 7 November 2025, https://www.energyflux.news/lets-get-physical-abaxx-takes-on-jkm-in-quest-for-lng-benchmark-status/.

Lane, P. R., *The euro in a changing world*, 9 January 2026, European Central Bank, https://www.ecb.europa.eu/press/key/date/2026/html/ecb.sp260109~7a044d36db.en.html.

Lerh, J., C. Aizhu, and S. Liu, "Volatility Surges on China Oil Futures after US Sanctions Yangshan Port." *Reuters*, 28 August 2025. Available from https://www.reuters.com/business/energy/volatility-surges-china-oil-futures-after-us-sanctions-yangshan-port-2025-08-28/.

"LME Warehouse Network." Available from https://www.lme.com/sustainability-and-physical-markets/warehousing/warehouse-network.

Meidan M., and A. Imsirovic, *The Shanghai Oil Futures Contract and the Oil Demand Shock*. The Oxford Institute for Energy Studies, July 2020. Available from https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/07/The-Shanghai-Oil-Futures-Contract-and-the-Oil-Demand-Shock.pdf.

Milgrom, P., and J. Roberts, "Rationalizability, Learning, and Equilibrium in Games with Strategic Complementarities." Econometrica 58, no. 6 (1990): 1255-1277.

"Minimum Volume Thresholds for Block Trades [Attachment 2 to Circular 17/230]." ICE, 2017. Available from https://www.ice.com/publicdocs/circulars/17230%20attach%202.pdf.

North D. C., *Institutions, Institutional Change and Economic Performance*. Cambridge University Press, 1990.

Onstad, E., and P. Desai, "Exclusive: CME Looks into Launching First Ever Rare Earth Futures Contract, Sources Say." Reuters, 11 February 2026. Available from https://www.reuters.com/world/china/cme-looks-into-launching-first-ever-rare-earth-futures-contract-sources-say-2026-02-11/.

"Opening Remarks of the Critical Minerals Ministerial." US Department of State, 4 February 2026. Available from https://www.state.gov/releases/office-of-the-spokesperson/2026/02/opening-remarks-of-the-critical-minerals-ministerial.

Parker, G. G., M. W. Van Alstyne, and S. P. Choudary, *Platform Revolution: How Networked Markets Are Transforming the Economy*. W. W. Norton & Company, 2016.

Peniket, D., "Brent and the International Petroleum Exchange." In Adi Imsirovic, *Brent Crude Oil*, 2023, pp. 91-109.

Pirrong, C., *The Economics of Commodity Trading Firms*. Trafigura, 2011.

"Platts Discontinues CPO and CPKO CIF Rotterdam Assessments Effective May 6." S&P Global, 6 May 2025. Available from https://www.spglobal.com/energy/en/pricing-benchmarks/our-methodology/subscriber-notes/050625-platts-discontinues-cpo-and-cpko-cif-rotterdam-assessments-effective-may-6.

"Platts Launches CIF Rotterdam Crude Palm Oil, Crude Palm Kernel Oil Assessments Nov 1." S&P Global, 1 November 2019. Available from https://www.spglobal.com/energy/en/pricing-benchmarks/our-methodology/subscriber-notes/110119-platts-launches-cif-rotterdam-crude-palm-oil-crude-palm-kernel-oil-assessments-nov-1.

"Port of Antwerp-Bruges ends 2025 with resilience in a turbulent trading climate." Port of Antwerp-Bruges, 27 January 2026. Available from https://newsroom.portofantwerpbruges.com/en/press-releases/port-of-antwerp-bruges-ends-2025-with-resilience-in-a-turbulent-trading-climate.

Port of Rotterdam, Annual Report 2025. Available from https://reporting.portofrotterdam.com/external/asset/download/project/f926250a-03f9-0000-55fb-e4e0519100a8/name/HbR_Annual_report_2025_highlights.pdf.

"Price Discovery." Available from https://www.cmegroup.com/education/courses/introduction-to-futures/price-discovery.

Raia, J., "Back to the Future(s): The Best Commodities Benchmarks Are Still Physically Settled." *Energy Connects*, 23 May 2024. Available from https://www.energyconnects.com/opinion/thought-leadership/2024/may/back-to-the-future-s-the-best-commodities-benchmarks-are-still-physically-settled/.

"Rare Earth Prices Show Regional Bifurcation Following Export Restrictions Imposed by China." Benchmark Minerals, 6 August 2025. Available from https://source.benchmarkminerals.com/article/rare-earth-prices-show-regional-bifurcation-following-export-restrictions-imposed-by-china.

Razavi, H., *The New Era of Petroleum Trading: Spot Oil, Spot-Related Contracts, and Futures Markets.* World Bank. Available from https://documents1.worldbank.org/curated/en/603911468739482147/pdf/multi-page.pdf, pp. 66-69.

Rochet, J.-C., and J. Tirole, "Platform Competition in Two-Sided Markets." *Journal of the European Economic Association 1,* no. 4 (2003): 990-1029.

Rochet, J.-C., and J. Tirole, "Two-Sided Markets: A Progress Report." *RAND Journal of Economics 37*, no. 3 (2006): 645-667.

SAFE. *Critical Minerals Pricing Mechanisms Issue Brief.* December 2025. Available from https://safe2020.wpenginepowered.com/wp-content/uploads/2025/12/SAFE-Pricing-Support-Issue-Brief.pdf.

Schofield, N. C., *Commodity Derivatives: Markets and Applications.* Wiley, 2021. Available from https://www.wiley.com/en-be/Commodity+Derivatives%3A+Markets+and+Applications%2C+2nd+Edition-p-9781119349105

"Shaping the Global Energy Transition." Available from https://h2-global.org/.

Silber, W. L., "Innovation, Competition, and New Contract Design in Futures Markets." *Journal of Futures Markets 1,* no. 2 (1981): 123-155.

The Board of the International Organization of Securities Commissions. *The Impact of Storage and Delivery Infrastructure on Commodity Derivatives Market Pricing.* 2016. Available from https://www.iosco.org/library/pubdocs/pdf/IOSCOPD530.pdf.

The Payne Institute for Public Policy. *Critical Minerals: Markets Primer.* June 2025. Available from https://payneinstitute.mines.edu/wp-content/uploads/sites/149/2025/06/Critical-Minerals-Markets-Primer.pdf, p. 39.

Trafigura. *Commodities Demystified: A Guide to Trading and the Global Supply Chain.* 2019. Available from https://www.commoditiesdemystified.info/pdf/CommoditiesDemystified-en.pdf

Union of European Federalists. *Mario Draghi's speech in Aachen.* 2026. Available from https://federalists.eu/federalist-library/mario-draghis-speech-in-aachen-14-05-2026/.

Van den Berghe, K., A. Peris, E. Meijers, and W. Jacobs. "Friends with Benefits: The Emergence of the Amsterdam-Rotterdam-Antwerp (ARA) Polycentric Port Region." *Territory, Politics, Governance 11,* no. 2 (Feb 17, 2023): 301-320, Available from https://doi.org/10.1080/21622671.2021.2014353.

Van Son, L., et al. *CommodipHy: The Commodification of Ammonia and the Role of Rotterdam as a Global Pricing Centre.* Research Report, Erasmus Commodity & Trade Centre, 2023. Available from https://www.eur.nl/en/erasmusctc/media/2023-03-commodiphy-research-report-march-2023.

"Where Coffee Was King." Available from https://www.bkwaterfronthistory.org/story/where-coffee-was-king/.

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