# Freight Trading in Bulk Commodity Supply Chains

Mads Frank Markussen & Liping Jiang

First edition, September 2026

First edition, September 2026

Published by Copenhagen Shipping Books
Copenhagen, Denmark

ISBN [insert ISBN when available]

# About the Authors

## Mads Frank Markussen

Mads Frank Markussen is a former freight trader and current Head of Freight Research and FFA at Navi Merchants and CM Navigator, both part of the Copenhagen Merchants Group. He has more than a decade of trading experience in dry bulk shipping and commodity markets, having previously worked as a freight trader at firms such as DS NORDEN and Louis Dreyfus Company (LDC). His work focuses on the intersection of freight markets and agricultural commodity trading, with particular emphasis on price formation, basis trading, and supply chain optimisation.

Mads Frank is closely involved in the development of digital trading tools, notably through CM Navigator, a platform combining trade flows, freight modelling, and market analytics. His professional work emphasises translating complex freight dynamics into actionable economic frameworks, enabling commodity traders to incorporate freight more directly into decision-making.

## Liping Jiang

Liping Jiang is an Associate Professor at Copenhagen Business School (CBS), where she specialises in shipping economics, maritime transportation and supply chain management. Her research focuses on the fundamentals and evolution of shipping markets, with particular emphasis on freight rate dynamics, shipping investment, maritime sustainability and the interaction between shipping operations and global trade.

Jiang's academic work combines economic theory, quantitative modelling and industry practices to analyse how shipping markets respond to changing economic, regulatory and geopolitical conditions. By integrating insights from economics, operations management and data analytics, she seeks to develop a deeper understanding of how the shipping market facilitates global trade while adapting to emerging challenges such as decarbonisation and supply chain disruptions. Her work aims to support both academic inquiry and applied decision-making in shipping and commodity trading.

# Acknowledgements

A special thank you to Kathrine Sofie Rasmussen for her contribution to the conceptual framework and data modelling behind the Value at Risk section.

We are also grateful to Marcus Christian Larsen and Anders Winther Jensen, whose questions helped clarify which topics may appear obvious to experienced practitioners, but remain far from obvious to aspiring juniors.

# Contents

# Chapter 1

# Preface

## 1.1 Motivation

In December 2024, one of the authors met a group of wheat traders at the European Commodities Exchange in the Grand Palais in Paris. During the discussion, a simple but revealing question emerged: why does freight remain difficult for many commodity traders to use in practice?

It is not because freight markets are impossible to understand. Rather, commodity traders find that freight is often presented in a language that does not connect with how commodity traders think about commercial decisions.

Freight is often discussed as a separate shipping topic rather than as part of the commercial logic of commodity trading. As a result, traders may struggle to see how freight reshapes the economics of a trade. Freight influences the value of an origin, the attractiveness of a destination and the real economics behind a flat price, basis level, or delivered offer. Consequently, a cargo that appears profitable on paper may become uneconomic once freight is included. A destination that initially seems unattractive may become competitive when freight conditions change. Similarly, a hedge that looks clean may still leave a trader exposed if the underlying physical movement is misunderstood.

The traders in Paris asked for freight to be translated into the language of commodity trading. They wanted freight concepts explained through familiar economic principles rather than isolated shipping jargon. They wanted to understand how freight links to arbitrage, delivery economics, spreads, execution risk, and physical optionality.

This book is written in response to that need. It treats freight not as a separate technical subject, but as an integral part of the economic machinery of commodity trading. The goal is to help commodity traders understand freight well enough to ask sharper questions, price trades more accurately, judge risk more clearly, and see opportunities that are often missed when freight is treated as an afterthought.

## 1.2 A Book for Undergraduates and Young Professionals

The global economy relies on complex supply chains, from the food we humans eat and the energy that powers our homes to the materials that underpin modern infrastructure. At the centre of these systems are the commodities traded and the freight markets that connect producers with consumers. Our experience is that most academics treat shipping and commodity markets as separate subjects, leading much research to focus on one subject or the other, although it is difficult to quantify. In practice they are deeply interconnected through not just decision-making, logistics and risk management - but also PnL.

This book aims to fill this knowledge gap. It is designed as an entry point into the fascinating world of freight trading and commodity supply chains, written primarily for undergraduate students, young professionals, and those embarking on their journey into these industries.

Combining economic theory with practical trading applications, the book draws extensively on anonymised real-world examples, particularly from Copenhagen Merchants Group, to show how freight and commodity markets interact in practice. The chapters start from the economic building blocks that underpin supply chains, progress to the specifics of trading practices, and conclude with how these elements interact to shape the modern global economy. The book will explore essential questions such as these: Why do nations rely heavily on maritime trade? How are freight rates set in volatile markets? What drives the price dynamics of key commodities like grain, biomass or sugar?

Importantly, this book also introduces a novel way of pricing basis risk in freight markets through a Value at Risk (VaR) framework. By linking freight pricing, hedging and risk management more directly to freight trading practice, the framework illustrates how freight desks and commodity traders can evaluate exposure within a unified economic structure.

Freight and commodity trading are not merely professions; they are dynamic, evolving crafts that sit at the intersection of economics, logistics, and human behaviour. They require both analytical precision and creative problem-solving. This book hopes to spark curiosity, equip readers with essential knowledge, and inspire them to approach these industries with the ambition to innovate and thrive. The goal is not just to learn facts, but to think critically about the complexities and opportunities of modern bulk commodity supply chains.

Welcome to the world of freight and commodity trading, where theory meets practice and every decision shapes the global flow of commodities.

# Chapter 2

# Introduction

## 2.1 A Mental Model of Freight Trading

A model often evokes images of dry, academic procedures. Yet, the aim of this book is more pragmatic. It offers a mental model of freight trading inside commodity supply chains. The goal is to bridge the gap between random guesswork and systematic reasoning rooted in economic theory. When applied consistently, this model functions as an "operating system" for navigating a market that is complex, competitive and highly interdependent.

The ambition is not to build a rigid model that "predicts" freight rates. Freight is shaped by a range of interacting forces: volatile fuel prices, shifting seasonal harvests, geopolitical disruptions, operational bottlenecks and fluctuating global demand. Any model that pretends to forecast perfectly will fail. A rule of thumb from the front line is that a trading company normally gets six out of ten right, but cuts its losses on the four losers and lets the six winners run. The mental model in this book is designed to be adaptive and robust: it helps the practitioner form a view, test it, update it and make decisions under uncertainty when reality deviates from plan.

To do that, this book combines inductive and deductive reasoning (Saunders et al., 2009). Induction begins with observing real-world recurring patterns and proposing theories grounded in actual data. Deduction challenges these explanations, testing whether the proposed hypothesis holds across time, routes and conditions, and whether alternative explanations fit the evidence better. This “stress-testing” mindset reflects a falsification principle: rather than collecting evidence only to confirm a view, the analysis actively looks for observations that could invalidate it. This balance between theory-building and rigorous testing helps make the framework more resilient.

Because the real world always exceeds what any model can capture, the book treats analysis as the use of mental models, which are simplified representations that make complex adaptive systems manageable. That creates a trade-off. Simplicity makes decisions possible, but it also means important details are filtered out such as risk preferences, charter-party nuances, and shifting operational constraints. The practical implication is straightforward: treat models as tools rather than truths, and keep updating them as new information arrives.

The central theme across the book is price. Prices coordinate fragmented supply chains across actors, regions and times. Freight is not merely a cost in commodity trading; it is one of the key channels through which imbalances are resolved. Section 2.2 explains how this logic applies within bulk commodity supply chains, while Figure 2.1 summarises the structure of the book.

## Structure of the Book: From Market Fundamentals to Risk Adjusted Decisions

| | | |
|---|---|---|
| **1** | **Introduction**<br>Introduction to freight and commodity markets, with a focus on freight's role in the supply chain. | **Chapter 2: Introduction**<br>Supply chains, physical trading, FOB vs CFR. |
| **2** | **Economic Logic**<br>Understand the mechanisms that drive price behaviour: scarcity, incentives, competition and opportunity cost. | **Chapter 3: Economics**<br>Price formation, competition, elasticity and opportunity cost. |
| **3** | **Market Analysis**<br>*Where pressure exists*<br>Diagnose tightening and loosening across commodity and freight markets through supply, demand, balance sheets and market pressure. | **Chapter 4: Balance Sheets**<br>Commodity and freight balance sheets, tonne miles, regional pressure and market analysis. |
| **4** | **Transformation Margin**<br>Explain how traders create value by moving flows across space, time and form. A special focus on space given the nature of freight. | **Chapter 5: Space, Time and Form**<br>Transformation margin, optionality and the business logic of trading decisions. |
| **5** | **Basis, Instruments and Applications**<br>Measure physical exposure against market references such as cash versus futures, freight basis and benchmark indices. | **Chapter 6: Basis Trading**<br>Cash versus futures, freight basis, FFA and relative value trading. |
| **6** | **Risk Based Pricing**<br>Price residual basis risk after hedging, while accounting for liquidity, VaR and governance constraints. | **Chapter 7: Value at Risk Based Pricing**<br>Residual basis risk, hedge design, minimum premium and governance. |

### THE UNIFYING PRINCIPLE

Every freight decision involves a trade off. The book moves from economic logic, to market diagnosis, to value creation, to basis and instruments, and finally to risk adjusted pricing, so that the practitioner can make better commercial decisions under uncertainty.

Figure 2.1: Structure of the book: From Market Fundamentals to Risk Adjusted Decisions.

## 2.2 Understanding Bulk Commodity Supply Chains

Bulk commodity supply chains involve the transportation of bulk cargoes such as agricultural products, iron ore and coal. They matter immensely for the global economy as they are essential for global food and energy security, economic stability and daily life. The distribution of these commodities moves through a sequence of links and nodes. At origin, raw materials are produced or extracted in surplus regions (for example, grain in major exporting areas, iron ore near mines, or coal in producing basins), collected and stored in appropriate facilities, and then moved by truck or rail to ports or rail terminals. From there, cargo is loaded onto bulk carriers for sea transport to importing regions such as Europe, Asia, or Africa. At destination, it is discharged and processed further or delivered to downstream channels serving industrial users and distributors, such as mills, power plants, steelworks, factories, or retailers. Rather than functioning as one centrally managed end-to-end pipeline, a bulk commodity supply chain consists of links managed by different actors with varied incentives and constraints. Therefore, the overall efficiency and reliability of the bulk commodity supply chains depend on how well these links coordinate.

We define a supply chain as follows: *"A supply chain is defined as a set of three or more entities (organisations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer."*Mentzer et al. (2001)

Pricing is the primary mechanism that coordinates individual links and holds the supply chain together. Prices such as commodity prices, freight rates, exchange rates and storage costs convert vast amounts of dispersed information into price signals that guide decisions throughout the supply chain. When these prices move, the supply chain adjusts: commodity flows are rerouted, inventories move across regions and time, and profit margins shift from one segment to another. In this way, price changes actively reshape the supply chain in terms of who ships what, when and where.

Trading is what turns these price changes into the physical movement of bulk commodities in the supply chains. It connects buyers and sellers across geography and time under uncertainty. Trading is not just about "buying low and selling high" activities. As shown in Figure 2.2, the trader operates a parallel chain alongside the vertical physical chain. The physical chain is relatively linear, linking origins, transportation and delivery into one continuous flow. However, it cannot manage the commercial and financial layer around the trade: price exposure, freight fixing, documentation, financing, insurance and credit. That is where the trader creates value alongside the physical supply chain by reducing transaction costs, coordinating logistics and contracts, providing finance, and bearing risk between origin and destination markets.

**Commodity supply chain with parallel trader layer**

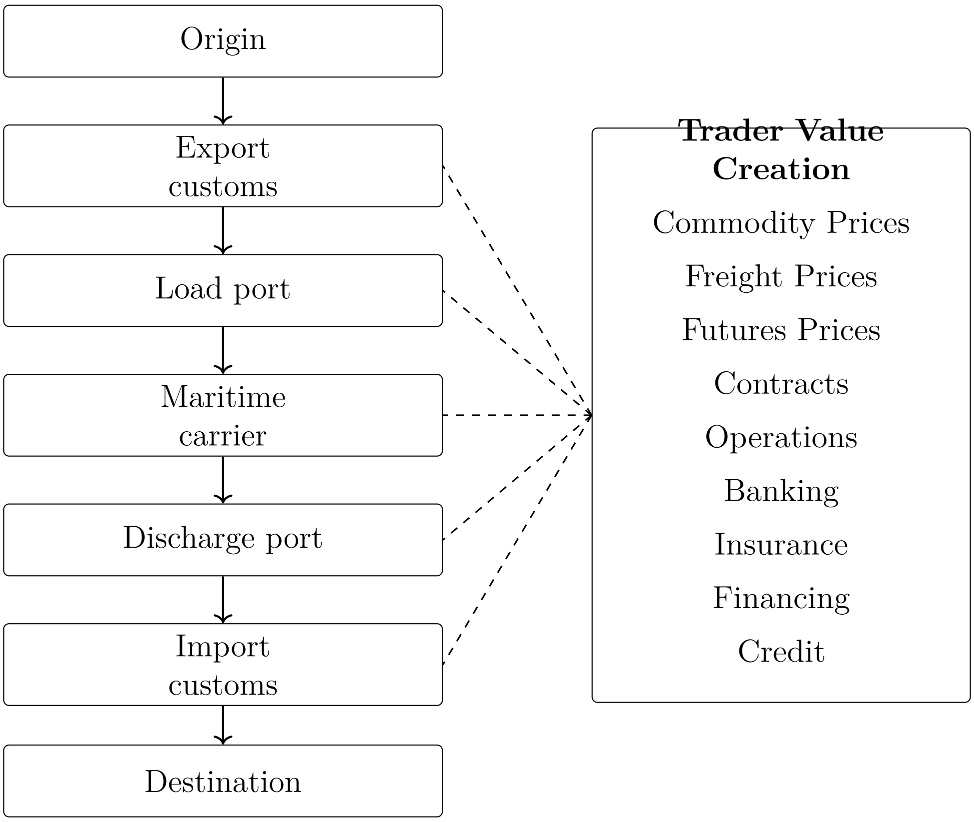



Figure 2.2: Vertical supply chain view showing the trader as a parallel value-adding layer across the execution chain. The trader creates value by reducing transaction costs, coordinating logistics and contracts, providing finance, and bearing risk between export and import.

To make it more tangible, imagine a wheat trader that buys Free on Board (FOB) at an export port and sells Cost and Freight (CFR) to a wheat mill in North Africa. A vessel that arrives late could miss its laycan, meaning that it fails to arrive at the loading port and tender valid notice of readiness by the cancelling date. The margin can then vanish through additional storage costs, contractual penalties or a cancelled sale.

The trader protects the deal by keeping options open, for example switching to an alternative vessel or rolling hedges so price risk stays covered while timing slips. Another example is when the buyer's bank rejects the presented documents because they do not conform to the letter of credit (LC). Here, the trader creates value by resolving the discrepancy quickly: coordinating any LC amendments among the buyer, seller and banks and ensuring that the documents conform to the LC. In both cases, the trader's edge is coordinating these links, preventing execution issues and absorbing the execution risk that neither farmer nor buyer wants to carry.

At the centre of this trading system is the human element. Markets do not react mechanically; in fact, they are shaped by traders' ability to translate various price signals into decisions about physical flows. To make such decisions, traders must blend economic reasoning with a good understanding of geopolitics, logistics constraints and market psychology. Their decisions are made in high-pressure environments where information is incomplete, timing is critical and small errors can have significant financial implications. At the same time, traders need to adapt to a rapidly changing world, where changes in consumer demand patterns, trade policy, technology, climate impacts and geo-economics constantly reshape the trading environment. This work requires not only technical capabilities, but also critical thinking and ethical considerations to outperform competitors. The decisions made by traders can affect employment, economic stability and access to essential goods for populations worldwide.

### 2.2.1 Physical Trading

Before we examine the commodity supply chain, we need to understand what a trade looks like in practice. Physical trading is the buying and selling of commodities with actual delivery from producers to buyers. Traders are responsible not only for price-making but also for managing the physical process: assembling volumes, arranging storage, delivering on contract terms to meet customer specifications and maximising profits (Pirrong, 2015). Figure 2.3 illustrates this as an FOB-CFR trading chain arranged by phase. In the contracting stage, the producer offers an FOB cargo and specifications, the trader converts this into a back-to-back position by buying FOB and selling CFR, and the buyer agrees the CFR purchase. At origin, the producer prepares the cargo and export documentation, while the trader books the vessel and coordinates the loading plan. The dashed line marks the critical handover at the load port: once the cargo is on board, the FOB delivery is completed and risk transfers under the CFR sale, even though the trader still controls the onward carriage. From that point on, the trader manages the execution of the freight and the bill of lading, while the buyer pays and receives the shipping documents before handling import and discharge. In other words, the trader sits in the middle translating an origin-side FOB process into a destination-side delivered transaction, carrying the execution risk that arises around loading, freight performance, and document conformity.

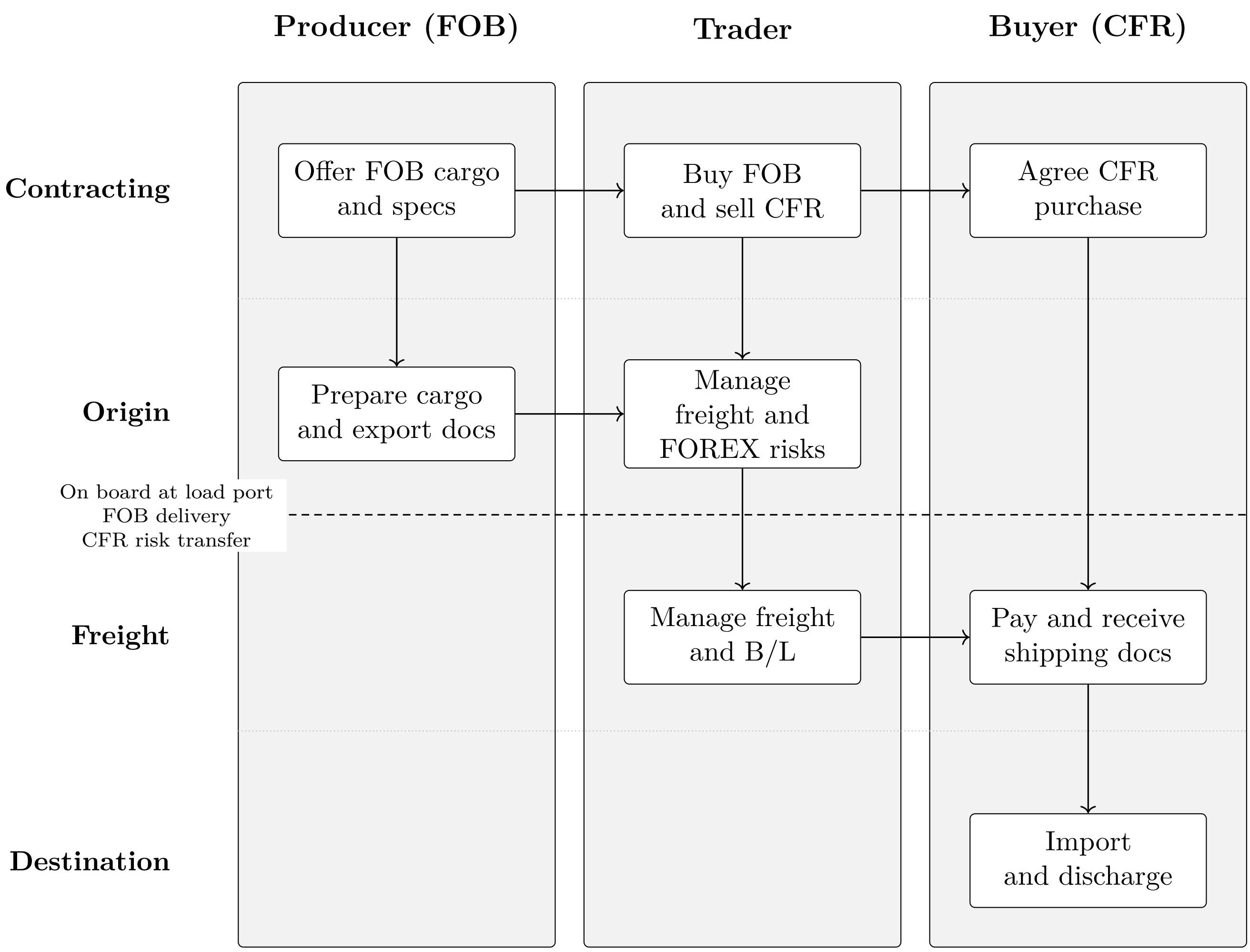



Figure 2.3: Responsibility across an FOB-CFR trading chain. Note that the figure is arranged to be read from top to bottom by phase. The dashed horizontal line marks the load port point where FOB delivery occurs and risk transfers to the buyer under CFR.

Physical trading therefore allows two things at once: getting the price right and getting the process right. Once a trader has turned an origin-side FOB offer into a destination-side CFR sale, the position is only profitable if it is executed as the contracts require. The commercial idea of "buying FOB, selling CFR" may sound simple, but the reality is operational. When reality deviates, the edge is the trader's ability to solve problems quickly without letting costs, delays or claims erode the margin.

In that sense, today's physical trader has evolved from a merchant who historically travelled to source and sell into a specialised coordinator. Modern commodity markets are far too complex for generalists to manage. Specialisation is essential because physical trading now relies on deep market knowledge, logistics networks and practical expertise. Large trading firms may operate across multiple commodity clusters, but they typically do so through specialised teams. Scale helps mainly through shared infrastructure, stronger banking relationships and the ability to manage risk across many flows, rather than through any single team covering everything.

Physical trading spans broad commodity groups, which are generally grouped into four clusters: energy, agricultural commodities, soft commodities and metals. Each cluster comes with its own distinct trading mechanisms, logistics, storage, and pricing dynamics. This is why firms organise into specialist desks.

Energy is by far the largest cluster (Pirrong, 2018), covering crude oil, refined products, coal, natural gas and electricity. These markets are shaped by the need for continuous and uninterrupted supply. When supply is constrained, the marginal energy supply matters disproportionately, and small disruptions can drive large price moves. Storage constraints are central: electricity storage is limited by cost and duration, while gas storage is capacity constrained and location dependent. In such a setting, prices can behave in counter-intuitive ways, turning to negative prices as market participants may pay others to take surplus output if it represents a more economically sound decision than to store it, or if the seller has run out of storage capacity. Notable companies active in energy trading markets include Vitol, Trafigura, Shell and British Petroleum (BP).

Agricultural commodities cover grains and oilseeds such as wheat, corn, soybeans, barley, rapeseed and rice. These markets are shaped by harvest cycles, weather, yield expectations, food demand, animal feed demand and biofuel policy. Storage is possible, but quality, moisture, grade and location matter, so the spread between local cash prices and futures prices is central to trading. Logistics are also important because crops must move from inland growing regions to export terminals, processors and end users. Demand for staple food commodities is relatively insensitive to price in the short run because these goods are necessities.

Soft commodities include sugar, coffee, cocoa, cotton and even orange juice (yes, orange juice even has a futures market). These markets are substantial, even though they often receive less attention outside specialist circles. Production is concentrated in tropical regions, so supply of these commodities is often shaped by weather risk, crop disease or political instability. Traders often "go to origin," engaging directly with farmers, suppliers and local exporters. This practice may sound adventurous, but it usually involves more spreadsheets than safari hats. Participants include large agribusiness groups (ADM, Bunge, LDC and Cargill) as well as specialist traders like Czarnikow, SUCDEN and EDF Man.

Metals trading in a formalized form dates back to the 19th century when the London Metal Exchange (LME) was established. Metals can often be stored for long periods without spoilage, so warehousing becomes central to the trading logic. That links directly to carrying costs, stock levels and inventory management. Large trading firms include Trafigura, Glencore and IXM. Metals are often discussed as:

1. Base Metals: Aluminium, Copper, Lead, Nickel, Tin, Zinc.

2. Precious Metals: Gold, Silver, Platinum, Palladium.

3. Speciality Metals: Tantalum, Cobalt, Molybdenum, and others.

4. Ferrous Metals: Iron ore, Steel.

Across all these commodity clusters, the common theme is the same: physical constraints and logistics shape what can be traded, when it can be traded and at what cost. This is where freight becomes essential. Freight is not an "add-on" to the trade. It is a link that turns an origin price into a delivered price and connects surplus with deficit, supply with demand. The "Law of One Price" suggests that identical goods should converge in value across locations, with any price differences largely explained by transportation costs. In the real world, convergence is imperfect. Frictions, such as vessel delays, port congestion, weather disruption and default risk, create gaps between "theoretical" and "achievable" delivered prices. Those gaps are not just noise; they are exactly the space where traders operate, turning inefficiencies into tradable opportunity.

### 2.2.2 Freight as a Strategic Link

Freight is the backbone of the commodity markets because it turns "where goods are produced" into "where goods can be consumed". Its importance extends beyond mere logistics; it is the vital link that connects producers with global markets and enables the smooth functioning of commodity supply chains. Figure 2.4 shows this logic as a simple bulk supply chain. Upstream, commodities originate at farms or mines in surplus regions. They must be assembled and stored, moved to an export terminal, and made "shippable" through handling and documentation. The freight market sits in the middle, linking export and import systems. Downstream, the cargo flow continues through an import terminal to the processor or end user in a region with a deficit of goods. In this setting, trade works only when the destination buyer is willing to pay enough to cover (i) the commodity value at origin and (ii) the full cost of moving it through every step of the chain: inland assembly, storage, port handling, ocean freight and import handling. When any link becomes scarce, for instance terminal congestion or vessel unavailability, freight costs rise and timing becomes uncertain. Under that scenario, freight is no longer a logistical link but the bottleneck that determines whether a cargo can move.

The soybean trade is a concrete example of how this bottleneck shows up in practice. Soybeans are available inland in Brazil, while an Asian crusher needs beans delivered within a fixed production window. The soybean therefore has to clear every box in Figure 2.4. The trade works only if the delivered price covers the farm value, plus inland freight, storage, export elevation, ocean freight and import handling. When vessel supply in the South Atlantic tightens, the freight link becomes the bottleneck. Specifically, freight rates rise, vessels are less available for the required laycan, and the likelihood of delays increases. Fewer buyers accept the higher delivered cost, FOB basis weakens at origin and only buyers with urgent demand continue to pay up. In other words, freight has not simply “increased costs”; it has determined whether the trade can happen at all.

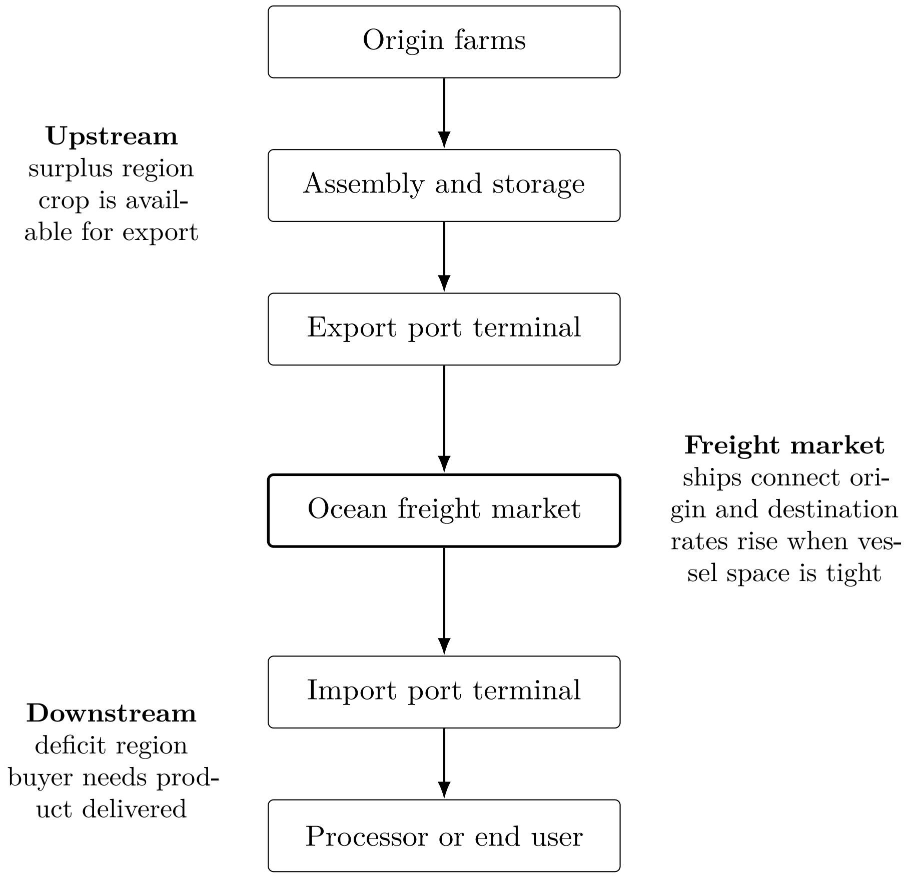



Figure 2.4: Freight as the strategic link in bulk commodity supply chains

The implications of freight differ among participants according to their roles in the commodity supply chain. For farmers, freight is a market-access mechanism. Most farmers are located far from major consumption hubs and export terminals. When inland logistics and ocean freight are cheap and reliable, farmers can reach more buyers and larger markets. When freight is less efficient or becomes constrained, local production surpluses can form even during strong demand, pushing prices down at origin and stressing farmer finances. This dynamic was starkly evident during the World Wars when shipping bottlenecks caused grain surpluses to pile up at ports, threatening the livelihoods of producers as they were unable to ship their goods and due to the unforeseen nature of the event, they did not have the infrastructure to store it either (Voznesenski, 2024).

For commodity traders, freight is not just a logistical or cost concern; instead, it is integral to whether a trade can be executed profitably while keeping risk under control. For instance, a trader buying FOB and selling CFR (Cost and Freight) or CIF (Cost, Insurance and Freight) must supply the commodity and arrange and pay for carriage to the named destination port. Under CIF, the trader must also arrange insurance. Under both CFR and CIF, delivery and risk transfer occur when the goods are placed on board the vessel at the port of shipment. Delays at the FOB stage, such as vessel unavailability or port congestion, can cause a missed shipment window, lead to default or trigger contractual penalties. Any delays at the FOB stage, such as vessel unavailability or port congestion, can cascade into missed CFR delivery windows, potential default and contractual penalties. Freight management therefore becomes an integral part of trading strategy and risk management. Scale matters here again as a source of operational resilience because traders with broader networks and resources can secure additional vessel supply, re-route flows through alternative supply chains and draw on stronger logistics expertise to ensure performance.

For downstream buyers, freight is the difference between "we bought it" and "we received it". Crushers, mills, refineries, and other industrial consumers often operate with tight throughput planning and limited ability to pause production. They value delivery reliability and timing as much as price. When freight markets tighten, delivered costs rise and lead times become uncertain, forcing buyers to draw down inventory, reduce utilisation or switch origin. This is why freight conditions translate directly into procurement decisions and pricing strategy.

Freight is therefore more than logistics. It is a market access mechanism for farmers, a contract performance constraint for commodity traders and a delivery reliability constraint for downstream buyers. Viewing freight through these lenses better explains why debates on investment in storage, port capacity, and shipping availability feed directly into prices and into whether commodity supply chains can function smoothly at all.

### 2.2.3 Evolution of Commodity Supply Chains

Commodity supply chains did not become global and freight-dependent overnight. They evolve as the cost, speed and reliability of moving bulk cargo improved. The underlying economic logic has always been the same, i.e. moving commodities from surplus regions to deficit regions, but the organisation of that movement has changed (Stopford, 2009). As transport became cheaper and more predictable, production and consumption could afford to separate geographically at scale and supply chains stretched into the global networks we recognise today.

Early bulk trade was constrained by slow sailing speed, limited port capacity and unreliable schedules. Over the 19th and early 20th centuries, advances in shipping technology and trade networks transformed the scope and scale of maritime commerce. The Industrial Revolution in the 19th century brought about an unprecedented demand for raw materials and railroads complemented this expansion by connecting inland production to port terminals. Ships grew larger and innovations like steam-powered engines enabled faster, more reliable voyages. This period was a turning point, underscoring the strategic role of efficient supply chains in unlocking economic growth on a global scale and establishing trade corridors. Origins could specialise in production, destinations could specialise in processing and consumption, and freight became the bridge between them.

A major milestone in the 20th century was the drive toward standardisation and process efficiency in logistics. The most visible example is containerisation, which standardised cargo units and interfaces between ship, rail and truck. It reduced handling time, damage, and coordination friction, and made global supply chains far more interconnected and efficient (Levinson, 2006). Even though bulk commodities move differently from containerised goods, the principle carries over: standardised interfaces and better port processes reduce friction, widen feasible trade routes, and increase the speed at which supply chains can adjust.

From the late 20th century onward, the next leap was information. Computerisation enabled real-time tracking of goods, predictive forecasting and streamlined inventory management. These advancements transformed logistics from a manual, paper-based process into a sophisticated, data-driven system capable of responding to changes in demand and supply with remarkable speed. Warehousing, routing and inventory systems became more efficient, facilitating just-in-time production and minimising storage costs.

The era of globalisation was marked by trade liberalisation, reduced tariffs and standardised trade practices, which expanded maritime trade and deepened interdependence across regions. As seaborne transport became cheaper and more predictable, it became economically efficient to produce where conditions were best and ship to where demand was strongest. Take the global grain trade, for example. Regions with high grain production, such as North America and parts of Europe, export to deficit regions in parts of Africa and Asia. Through efficient maritime supply chains, grain surpluses are shipped to regions facing deficits, stabilising food prices, supporting local economies and helping to alleviate food insecurity.

However, as supply chains grow more complex and lengthen, they also become more vulnerable to disruptions. Today's maritime supply chains are influenced by numerous factors, from economic policies and environmental concerns to geopolitical tensions and technological advancements. A delay or blockage in one part of the chain can have far-reaching consequences, as seen in recent global events like the 2021 Ever Given blockage of the Suez Canal.

While maritime trade has expanded, commodity supply chains have evolved into a tightly connected network with increased sensitivity to shocks. This evolution leads directly to the next question. If supply chains are longer, more specialised, and more time-sensitive than before, then competitive advantage increasingly depends on who can coordinate the chain, absorb disruptions, and reliably execute delivery. That is a question of market structure: who has the capability to perform, who can enter, and how those advantages are changing.

### 2.2.4 Market Structure in Transition

In bulk commodities, market structure is shaped less by who has the best price but more by who can coordinate execution across a long and fragmented supply chain. Historically, many major trading corridors have been dominated by a relatively small set of large trading houses and specialised intermediaries. Their advantage is not only scale in trading volumes, but scale in logistical capability: access to origins, access to storage and terminals, freight execution and financing. Those capabilities became natural barriers to entry.

Over the past decade, this market structure has begun to shift along two dimensions: First, competition for end customers has increased. Smaller and mid-sized traders have increasingly sought to bypass traditional intermediaries and sell directly to industrial customers, especially in fast-growing emerging markets. Several conditions have enabled this. For example, information has become more transparent and faster to access; trading specifications and contract frameworks have become more standardised; financing is available to a wider set of counter-parties than before.

As a result, this shift introduces more sellers into the market, allowing new or smaller traders to capture market share in markets that were previously dominated by larger intermediaries. However, the shift comes with a trade-off, as it pushes more operational complexity onto the new players. Without integrated infrastructure and execution depth, smaller players can struggle to access the main "motorways" of global trade consistently. In practice, the market becomes more open at the margin, while scale remains decisive in the core flows.

Second, bulk commodity supply chains now involve a broader set of stakeholders than the simple model of producer, trader and buyer suggests. Modern bulk flows depend on a wider ecosystem, such as farmers, processors, terminal operators, large multinational traders, logistics providers, financiers, retailers and procurement managers, each influencing whether a shipment performs. Coordination among stakeholders within this ecosystem becomes the key. Digital tools such as predictive analytics and artificial intelligence, improve visibility and are claimed by vendors to reduce inefficiencies along the supply chain. These technologies do not eliminate the advantages of large scale, but instead can lower informational barriers and transaction costs, making parts of the market more contestable. In fact, digitalisation tends to help smaller firms compete where competitiveness depends on speed and customer-specific execution, rather than ownership of a large number of assets or global networks.

## 2.3 Key Takeaways

- Commodity supply chains are fragmented in practice; prices provide the "glue" that coordinates decisions across actors, regions and time.
- Traders create value by executing across gaps in the chain, reducing transaction costs, managing risk and preserving optionality.
- Freight is a strategic link in commodity trade because it determines whether surpluses can reach deficit regions.
- The rest of the book develops this logic from economic principles to tradable freight decisions.

## 2.4 Connection to the Next Chapter

This chapter explains *why* freight matters in agricultural supply chains. The next chapter explains *how* prices, competition, and incentives work, providing the economic language used throughout the remainder of the book.

# Chapter 3

# Economics

## 3.1 Market Fundamentals

### 3.1.1 Assumptions

This part of the book introduces a small set of economic assumptions that we will use as a practical lens for freight trading inside commodity supply chains. The aim is not to prove any theory, but to offer readers a baseline for understanding freight and commodity markets. Further reading is recommended, and the bibliography of this book is a good place to start.

- Scarcity and opportunity cost rule logistics: Economics starts with scarcity: resources such as goods, time and skills are limited, and they have alternative uses. In freight, scarcity is physical and measurable, such as port capacity, vessel draft limits, storage space, and working capital. Every decision has an opportunity cost: a ship fixed Atlantic - Mediterranean cannot simultaneously serve US Gulf - Far East; cash tied up in one commodity cannot finance another. Freight rates are best understood as the price of allocating scarce freight capacity across competing cargoes, regions, time windows, and cargo owners.

- Prices coordinate fragmented supply chains: Commodity supply chains are lengthy and fragmented: different actors, contracts and regions. There is no central planner. Coordination happens through prices - commodity prices and freight rates - which translate dispersed information into a signal. These price signals indicate to market participants where goods should move and whether they should be stored, processed or shipped. In this book, price is treated not merely as a transaction number, but as the signalling language of the supply chain that links decentralised decisions to a global pattern of trade.

- Risk shapes decisions: Most market behaviour can be understood as incentive-driven decision-making under uncertainty. Profit is the reward for carrying risks, such as price, operational and counterparty risks. This helps explain why optionality has value, why spot tonnage can command a premium, why a tighter laycan costs money and why volatile routes tend to trade with a risk premium. In general, higher expected returns compensate for bearing higher risk (Sowell, 2014).

- Freight markets adjust with delays: Economic models often assume fast and symmetric information, as well as instant adjustment to new information. Freight markets don't work that way. Market information arrives unevenly because participants have different networks, broker flows and visibility into cargo flows. At the same time, the physical freight system adjusts slowly: for instance ships take weeks to ballast in, ships can take months to reposition or existing contracts can lock capacity for the next quarter. Because prices can adjust immediately while logistics cannot, freight rates may temporarily deviate from fundamentals or long-term averages, especially under disruptions.

- Regulations can distort freight markets: Freight markets do not consist only of private transactions. They operate within a regulatory framework set by international institutions and national authorities in areas such as safety, environmental protection and liability. Regulations therefore become part of the market environment that traders must price, anticipate and manage. They affect operating costs, feasible routes, port access and even which ships remain competitive after compliance costs. At the same time, direct government price controls can distort incentives and lead to surpluses, shortages and misallocation.

Taken together, these assumptions treat markets as the primary coordination mechanism—while recognising that freight is constrained by slow physical adjustment, uneven information, and a regulatory framework that protects shared resources. The rest of the chapter builds on this baseline to show how traders translate price signals, risk premia, and constraints into practical decisions.

### 3.1.2 Perfect Competition in Bulk Freight

Market structure describes how competition is organised in an industry or a market: how many participants operate, how easy it is for new competitors to enter, how differentiated the product or service is and how much influence any one participant has over price (Goolsbee et al., 2019). Market structures range from perfect competition to monopoly:

- Perfect Competition: Numerous firms offer identical services to customers who are price takers and no single company or customer can influence the market freight rates.

- Monopolistic Competition: Many firms provide similar but differentiated services, perhaps through specialised routes or value-added services. This allows for some pricing power based on perceived differences.

- Oligopoly: A few large firms dominate the market. High entry barriers, such as substantial capital investment and control over key routes, limit the number of competitors. These firms may engage in strategic pricing, but intense competition keeps rates largely determined by the market.

- Duopoly: Only two firms control the market. While uncommon in global shipping, certain regional routes might exhibit duopolistic characteristics.

- Monopoly: A single firm controls the entire market. In dry bulk freight, monopolies are rare due to international regulations and the vastness of global trade routes.

The bulk freight market is often well-approximated as perfect competition. This approximation is useful because it explains a central feature of freight: freight rates are shaped primarily by aggregated supply and demand, rather than by any single participant. At the market level, four features support this framework:

- Open Entry: Compared to asset-heavy industries, a freight trading desk can participate in freight trading without owning ships. New entrants can leverage existing infrastructure and technology without a significant upfront investment, although it requires serious working capital once the operation scales. As such, entry barriers are relatively low which allow new traders to enter the market with minimal obstacles. The ease of entry prevents the market dominance by any single entity, promoting competition and efficiency. After all, in freight trading, the casino is always open if you have just a little capital but make sure to count your cards.

- Price Takers: In this market, individual traders are price takers, adopting the prevailing market rates rather than controlling them. The large number of participants and homogeneous services ensure that a single trader's transactions are too small to move the market price. Instead, freight rates are determined by aggregate supply and demand forces on a global scale.

- Homogeneous Services: The freight service of moving bulk commodities from origin to destination involves standardised vessels and procedures, leading to services that are near-perfect substitutes. Customers perceive one trader's freight service as interchangeable with another's. Traders have to compete mainly on price and efficiency rather than unique features. This homogeneity requires a focus on cost management and operational excellence. In essence, when everyone offers the same carriage, success hinges on who can deliver it cheaper.

- Intense Rivalry: Numerous traders compete fiercely for the same clients. This fierce competition drives innovation and relentless pursuit of marginal gains. Traders continuously optimise operations to outperform rivals, leading to lower costs and improved services for consumers. The competitive pressure ensures that no one rests on their laurels. As the saying goes; if you snooze, you lose, it is a race where everyone is sprinting to stay ahead.

Perfect competition is therefore a strong starting point for understanding why rates move quickly when the balance tightens and soften when it loosens. However, it is only an approximation rather than a full description. In practice, several frictions can cause short-term deviations from a simple aggregated supply-demand story:

Uneven information. Information asymmetry is prevalent. Some participants have access to better networks, proprietary data or superior analytics, while others update later. This lag in information dissemination can allow those with timely insights to capitalise on opportunities before others catch up. It does not remove competition, but leads to temporary deviations from market aggregation.

Fast decisions under uncertainty. Shipping opportunities can arise and vanish quickly due to factors like sudden demand spikes, geopolitical events, or port congestion. Participants must make swift decisions, often under pressure and with incomplete information. This haste can lead to errors in judgement, such as mispricing a freight rate or misjudging the profitability of a route.

Bounded rationality. Participants are not always perfectly rational profit maximisers (Thorp, 2017). In the freight market, uncertainty, heuristics, emotions, and bias can shape choices: a shipowner might accept a lower rate due to fear of the vessel remaining idle, or a trader might overestimate demand based on rumours. These behaviours can lead to decisions that deviate from optimal economic models, creating inefficiencies that savvy participants can exploit.

A final issue matters for the broader supply chain context: while freight is often close to perfect competition, other links in the supply chain can be more concentrated or regulated. It means that commodities pass through multiple market structures on the journey from origin to the end consumer. This creates both a challenge and a unique opportunity for traders to find creative approaches. Traders who understand these mixed structural nuances can identify moments when the market behaves imperfectly, allowing them to capitalise on these discrepancies. We return to these deviations in more detail in the subsection on incentives and behaviour. For now, the competitive baseline gives us a clean foundation: at the aggregated level, freight prices are best understood as outcomes of market-wide balancing, not of individual control.

### 3.1.3 Buyers and Sellers

Having described the market structure that freight often resembles, we now examine freight buyers, freight sellers and the freight traders between them, who take price risk from both shipowners and charterers. Even in a highly competitive market, these actors differ in their constraints and objectives, so they do not value the same trade identically. Charterers typically seek to move goods efficiently on a given route and within a given time window, at the lowest feasible cost. Shipowners evaluate the same opportunity based on vessel availability, operating costs and the expected return from committing the ship over a longer period of time consisting of multiple voyages.

Figure 3.1 shows why regional freight spreads can persist under logistics constraints and how traders can respond to those spreads.

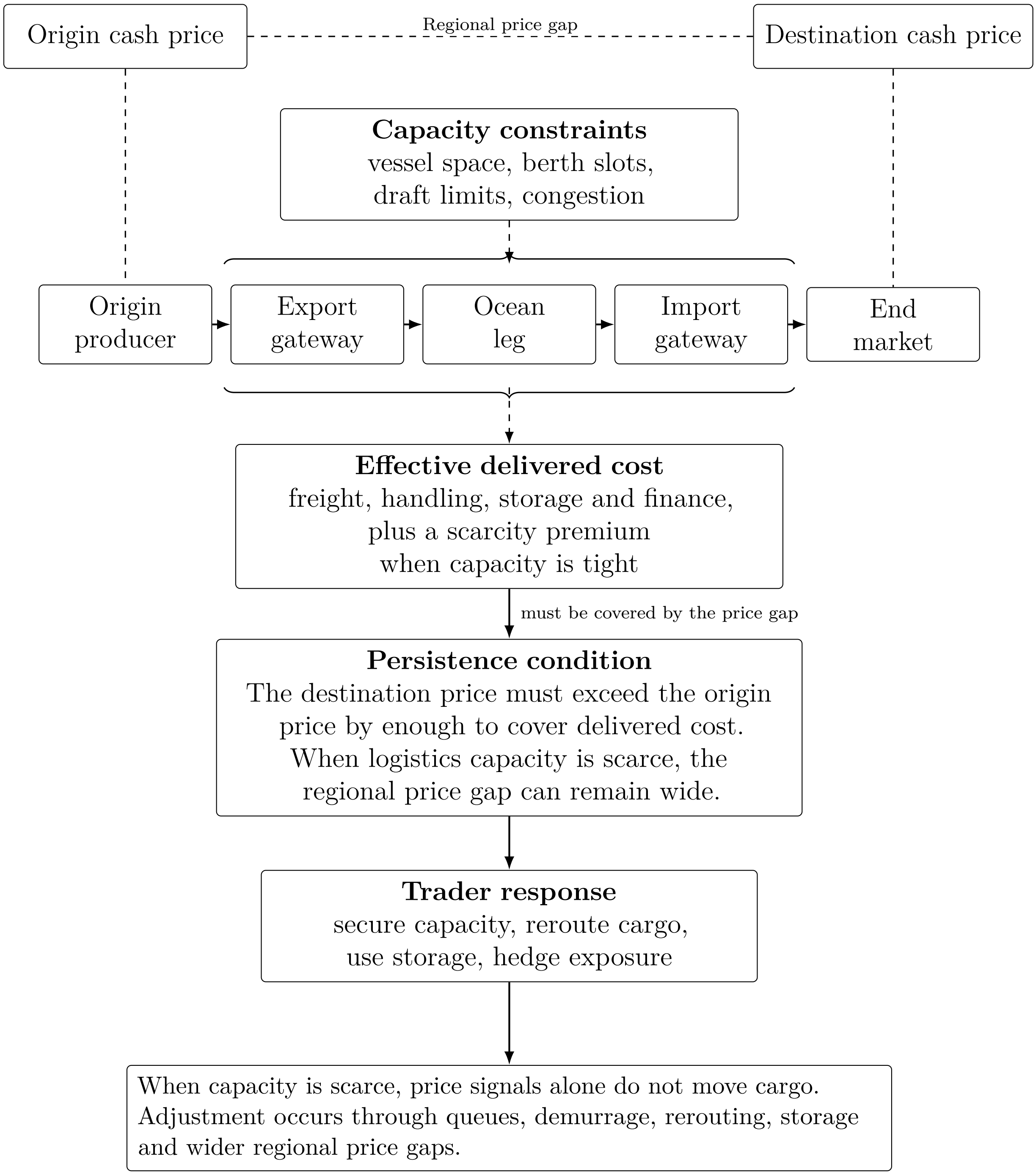



Figure 3.1: Economic logic of regional price gaps under logistics constraints and trader response.

This heterogeneity explains why there is no single freight rate at the transaction level. Some freight buyers are willing to pay higher rates for faster delivery or reliability, while others focus on minimising costs in exchange for longer transit times. Similarly, shipowners might prefer certain cargoes or routes that align with their strategic goals or offer better returns.

When analysing the freight market at an aggregated level, it becomes impractical to model every preference and constraint. We therefore use the concept of a "representative buyer and seller". This is not an assumption that participants are identical; rather, it is an assumption that their diverse behaviour can often be summarised in the aggregate for the purpose of explaining rate formation. When freight rates rise, the representative charterer tends to reassess their shipping needs, potentially reducing demand or seeking alternative routes. Concurrently, shipowners might allocate more vessels to high-demand regions to capitalise on higher rates. These systematic responses are the link between individual negotiation and the market-wide supply–demand balance.

This representative-agent lens allows classical economic theories to remain useful in freight. It facilitates the prediction of market trends, the setting of freight rates and an understanding of how supply and demand reach equilibrium. Individual deviations matter for execution and edge, but at the level of market structure and rate direction, aggregate behaviour is often enough to explain why prices move.

## 3.2 Price Fundamentals

### 3.2.1 Prices Coordinate Supply Chains

A trader rarely faces one price; they face a set of prices that jointly determine whether a transaction is feasible and profitable: the commodity price at origin and destination, the freight rate, storage and handling costs, financing costs, and exchange rates. These components fluctuate continuously and interact with each other. With that definition in place, prices coordinate fragmented supply chains through three practical channels: space, time and money. Each channel shapes where goods are sent, when they move and the financial terms under which the trade works.

Across space. Prices coordinate trade across regions. Traders compare the commodity price spread between locations relative to the costs of moving the goods. If the delivered spread covers the transport cost, trade flows are pulled toward the best route and origin; if it does not, the arbitrage is not possible and cargoes reroute or remain in the local market. In this sense, freight is not just a cost—it is the variable that often decides which supply chain segment connects to which.

Across time. Prices coordinate timing by rewarding either immediate movement or patience. The decision to ship now versus store and ship later is driven by the relationship between time spreads in the commodity price (spot versus forward values) and the cost of carry (storage, insurance, shrink, and financing). High carry costs push inventory out of storage and into the market; attractive forward spreads and cheap carry encourage holding inventory for later sale. This is how prices synchronise inventory behaviour with future demand.

Across money. Prices coordinate internationally by translating economics across currencies and balance sheets. Most commodity chains are international, so exchange rates and funding conditions change delivered competitiveness. A strengthening currency can make a country's exports more expensive and less competitive; a weakening currency can improve export competitiveness but raise the local cost of imports and financing. Traders therefore manage "net" prices after foreign exchange, interest, and operational costs, often hedging currency exposure to protect margins.

The practical implication is that traders monitor a price system, not a single quote. A drop in freight can reopen an origin into a destination; an exchange rate move can flip which supplier is cheapest on a delivered basis; a change in carry can shift the choice from shipping to storing. Understanding how these linked prices transmit signals is essential for navigating freight and commodity trading.

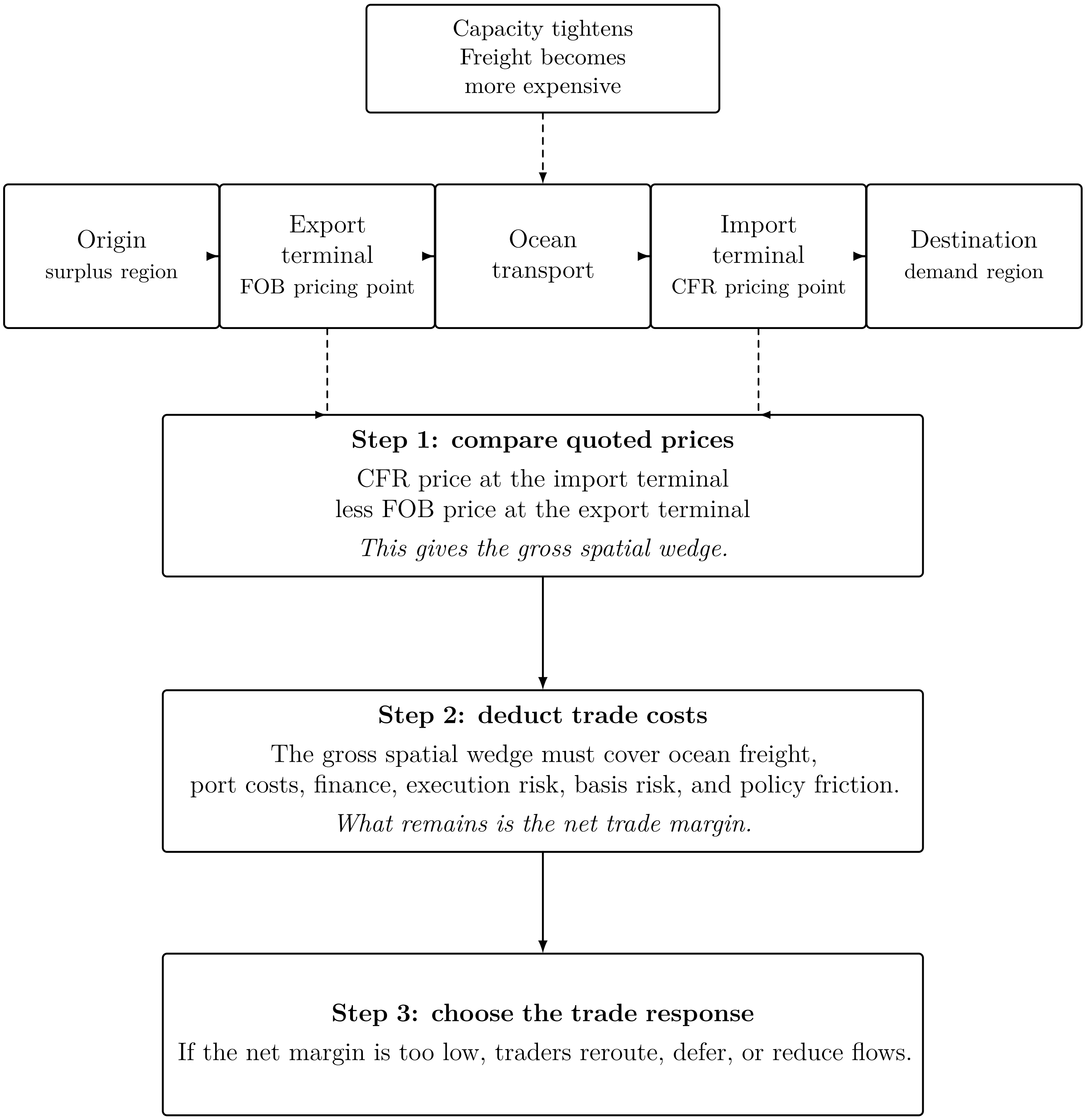



Figure 3.2: **From Price Quotes to Trade Response.**

A commodity trader may make an initial estimate of the implied freight rate by deducting a comparable FOB price from the CFR price. This spread is a useful starting point, provided that quality, shipment period, currency and unit are aligned, but it should not be interpreted as freight alone. It may also reflect loading and discharge rates and terms, financing, timing, basis effects, execution risk, the seller's carriage and documentary obligations, the trader's required margin and, where present, the value of embedded optionality. This book refers to treating the full FOB to CFR spread as pure freight as the "freight fallacy". Optionality is discussed further in Chapter 5.

### 3.2.2 Prices as Emergent Outcomes of the System

In freight trading, price moves are rarely the result of individual intent by "greedy" shipowners or "exploitative" freight traders. More often, prices move because the market is continuously matching cargo needs with freight capacity under changing constraints. This can be understood through a systems-thinking lens. The freight market behaves as a complex adaptive system: many decentralised actors respond to local signals, their actions feed back into the market and the aggregate outcome (the freight rate) emerges without central control (Choi et al., 2001) (von Hayek, 1988). In this market, individual shipowners, charterers and brokers make decentralised decisions about cargoes, routes and rates based on their needs, expectations, constraints and opportunities. No central planner directs these choices, yet the system reallocates ships across regions as price signals change. The market "adapts" through feedback: rates attract ships, ship movements change local balances, and those balances feed back into rates.

A simple example is a surge in grain exports from the Black Sea region. Regional rates rise not because of the collusion of shipowners, but because effective supply is limited and the region must attract the marginal vessel: the ship that is currently best employed elsewhere. If the Black Sea needs to pull that marginal vessel away from an alternative market such as US Gulf, it must pay enough to compensate the owner's opportunity cost. The result is a higher Black Sea rate and, if the diverted vessel tightens US Gulf supply, potentially a higher US Gulf rate. These changes can then propagate into adjacent markets as positioning and substitution ripple through the network.

Seeing freight as a complex adaptive system shifts the focus from "who sets the rate?" to "what decision rules turn local signals into global outcomes?" Figure 3.2 is a representation of that rule at the trade level: traders translate a price signal into a trade flow decision. They compare CFR and FOB prices to measure the spatial wedge, deduct the trade costs (freight, ports, finance and risks) and then choose the trade response. When many decentralised actors apply this rule in parallel, they collectively change realised flows and vessel positioning and that new balance feeds directly into the next round of prices.

Another defining feature of complex systems is that small local changes can have non-linear effects because responses spread through multiple channels in the system. For example, a rise in fuel prices raises vessel operating and ballast costs. A deficit region may therefore need to pay higher freight rates to attract vessels from elsewhere. If its cargoes cannot support the higher cost, fewer vessels may reposition there and cargo demand may shift. Surplus regions can meanwhile face lower rates as owners discount to avoid a costly ballast voyage. The rate impact differs across routes, time windows and vessel sizes. In markets where cargo demand can adjust, higher total costs may reduce demand and soften rates. Where demand cannot adjust easily, the same shock can intensify scarcity and lift rates sharply. Freight prices are therefore network outcomes rather than simple reactions to individual variables.

Freight models aim to describe this behaviour, but models are necessarily simplified maps, not the territory. A useful model identifies the main state variables, constraints, and the feedback loops that transmit shocks across basins. For example, a Handysize model for the Black Sea should not only track local demand and competing cargoes, but also the channels through which the system adapts: fuel costs, congestion, and inflows/outflows of tonnage from neighbouring basins such as the Mediterranean. Used correctly, models help traders identify which constraint is binding, which feedback loop is dominant, and what the next re-balancing step is likely to be.

This framing sets up the next subsection on price formation: if rates are emergent outcomes of a complex adaptive system, then “formation” is best explained as the interaction of constraints, opportunity costs, and adjustment lags—rather than a single-driver story.

### 3.2.3 Freight rate formation

The economics of bulk grain transport operate in a way that often looks like a macro-level equilibrium, with supply and demand forces setting freight prices across regions and seasons. In this model, shipping rates fluctuate based on factors like fuel costs, demand shifts due to geopolitical tension, and weather patterns that affect harvests. For example, during times of grain abundance, such as bumper harvests in the United States or Brazil, shipping rates may increase due to increased competition (demand) for ships among exporters. In contrast, in periods of drought or crop failure, shipping rates may drop as there are fewer volumes to transport. In these cases, macro fundamentals explain where the market is headed.

Yet, the rate paid on a specific freight contract (fixture) is not determined by market fundamentals alone. Rather than assuming an "average global" trading pattern with a standard vessel specification, the heterogeneity of individual freight trading also matters. For instance, trade specific factors such as vessel-, route- and contract-specific determinants influence the freight rate of an individual contract (Adland et al., 2017). This is because an individual freight contract matches a particular cargo with a specific ship for a certain voyage agreed by the traders. The assumption of many buyers and sellers trading an identical service does not always hold in a micro-level market. Instead, the "relevant market" is the feasible set of ships for that cargo, route and timing. It depends on the supply and demand of that specific micro-environment: how many vessels are i) commercially open, ii) suitable for the cargo and parcel size, iii) able to meet the loading window and perform the voyage to the discharge port, and iv) acceptable to both charterers and shipowners under the contract terms.

In addition, market psychology and bargaining power between charterers and shipowners also affect the freight rate for each individual match (Zannetos, 1966). Bulk commodity markets are often shaped by different incentives across supply chain participants, each influenced by their unique economic priorities. For instance, grain producers prioritise timely export of their harvests to avoid losses from spoilage and storage costs. Traders and commodity firms on the other hand leverage market information to buy low and sell high, focusing on price arbitrage and hedging strategies that allow them to manage the risks of price volatility. These incentives influence timing, optionality and urgency of freight trading, which can affect the freight price even when the overall market fundamentals are unchanged.

Game theory can provide insight into these competitive interactions in freight negotiation and trade timing, particularly in the grain market. For instance, traders and shipping firms might engage in a "sequential game" as they try to predict each other's actions in response to weather forecasts, geopolitical news, or shifts in demand. A shipowner might quote a higher freight rate in anticipation of a major export season, expecting grain traders to pay a premium to secure transport. Similarly, grain exporters may time their shipments to coincide with lower shipping rates or reduced competition for vessel space, capitalising on strategic knowledge of other players' actions. These examples highlight that freight prices are shaped both by market-level forces and by micro-level interactions, constraints and bargaining.

### 3.2.4 Elasticity

Elasticity is a measure of how much the quantity demanded or supplied of a good changes when its price changes. This is important for predicting market reactions to price shifts (Goolsbee et al., 2019). In freight markets, elasticity helps to answer two practical questions: i) demand elasticity: how much (and how fast) cargo demand changes when freight becomes more expensive; ii) supply elasticity: how much (and how fast) vessel supply can respond when rates rise. A useful starting point for understanding price elasticity is the time horizon. Both demand and supply in freight markets are typically inelastic in the short term; but the longer the time horizon, the more elastic they become because economic incentives can shape markets to find alternative solutions in the long run.

**Demand elasticity** When it comes to transporting essential goods like grains and other agricultural products, the sensitivity to price change is often limited in the short term. This is because freight demand is largely derived demand: it stems from underlying commodity flows that are determined by harvests, sales contracts and consumption needs rather than by freight rates themselves.

Once commodities reach the port, shippers commonly face two broad choices: ship or store and wait. This narrowed choice set makes demand for sea transport relatively price inelastic in the short term. Storage can be constrained and costly and may introduce quality and execution risk, so it is often an imperfect substitute for shipment. However, many dry bulk commodities can be stored, and delay is not inherently impossible.

Freight can be a modest component of the delivered price of some essential commodities, so small increases in freight rates may have little immediate effect on final consumption.

However, for low value bulk cargoes or long routes, freight can be a material share of delivered cost and can change origin choice, shipment timing and traded volumes. Importers may therefore absorb small increases, switch origins, defer purchases or alter shipment timing, even when underlying consumption remains broadly stable.

That said, demand for freight service is rarely perfectly inelastic. Even when total annual import needs are stable, transport volumes can shift across origins, routes and timing. These adjustments typically matter more for traders and charterers than for end-customer demand. In practice, freight price changes more often reallocate flows and shift timing than alter final demand, especially over short horizons.

**Supply elasticity** On the supply side, freight markets are typically more inelastic in the short run because capacity is constrained by physical assets and operational bottlenecks. The availability of ships, port infrastructure and established trade routes means that capacity cannot be quickly adjusted in response to price changes. Over weeks and months, the active fleet is largely fixed and building new capacity takes years. This rigidity limits the industry's ability to respond swiftly to market fluctuations, maintaining the inelastic nature of supply.

Shipowners do have options to reduce effective supply in the short run, such as slow steaming, idling vessels or placing them in dry dock. These actions mainly affect effective capacity at the margin, but rarely enough to offset a major demand shock. Over longer horizons, supply becomes more elastic through redeployment between regions, reactivation or lay-up decisions, ordering or scrapping. This is why freight markets often exhibit pronounced cycles: demand can move more quickly, while supply adjusts slowly with lags. In short, freight demand for essential commodities is often inelastic in the short run, while freight supply is typically more inelastic.

## 3.3 Trader Fundamentals

### 3.3.1 Incentives and Behaviour

This section explores the logic beneath observed market behaviour: what shapes the actions of market participants. Standard microeconomic analysis often begins with individual agents who choose among alternatives subject to preferences and constraints. Simplified representative-agent models may impose common decision rules, but utility maximisation does not generally require homogeneous motivations or preferences.

Companies may pursue sustainability and social objectives as well as financial outcomes, while individuals may value social norms, altruism and sustainability. Such behaviour does not necessarily contradict utility maximisation at the individual level, because utility can include altruistic and non-financial preferences. It does show why models based only on financial self-interest may fail to explain observed behaviour. Marginal utility differs across individuals because of wealth, preferences and circumstances, which complicates aggregation (Keen, 2011).

However, this framework often struggles when applied to society at large because individuals do not always act purely out of self-interest or rational calculation. Social norms, altruism and varying preferences introduce complexities that classical economics does not fully capture. For instance, individuals might engage in sustainable practices that do not necessarily maximise personal financial gain but contribute to social welfare (Keen, 2011). These actions deviate from the classical assumption of utility maximisation based solely on personal benefit. Moreover, the concept of marginal utility, the added satisfaction from consuming an additional unit of a good, varies greatly among individuals due to differences in wealth, preferences and circumstances. When such variations are aggregated, predicting societal demand becomes challenging and the classical model's simplicity falls short.

At the macro level, the shipping industry is a setting where classical reasoning often performs better. Freight is a relatively standardised service and behaviour is mainly driven by efficiency and financial constraints. "Doing good" is rarely rewarded directly through pricing because there are limited mechanisms that pay market participants for altruistic outcomes.

Shipping also has a feature that reinforces this behaviour pattern. The demand for shipping services is driven by the need to move commodities efficiently from one location to another and each ship contributes capacity to fulfilling this demand. Unlike consumer goods, where marginal utility concerns satisfaction from consumption, a ship is a productive asset that adds transport capacity. The economic value of additional capacity is not constant; it depends strongly on vessel suitability, position and the current balance between vessel supply and cargo demand. This helps explain why small changes in effective supply or demand can cause large rate movements in a tight market but much smaller movements in a loose one.

Yet, anyone who has ever traded in freight markets knows a key nuance: the ship might be interchangeable, but the shipowner's will is not. Owners differ in risk appetite, liquidity needs, negotiation style and these differences show up most clearly in individual freight contracts. Charterers also differ in various manners, such as timing pressure and cargo constraints. This is where micro-level outcomes can deviate from a traditional classical model. These deviations are not a contradiction of supply and demand, but are the result of the stochastic nature of constraints and bargaining skills at the point of execution.

### 3.3.2 Opportunity Costs

Opportunity cost is the value of the next best alternative forgone. In freight trading, freight traders and shipowners constantly decide how to allocate limited resources, including vessels, capital and time. Every commercial choice reveals what decision makers value most at that moment, whether utilisation, optionality, risk exposure or a mix of all three. Seen this way, opportunity cost is a daily operating principle. It is the benchmark against which execution should be judged: was this the best available use of the ship, given what we knew and what we were trying to optimise?

Figure 3.3 provides a practical framework for applying opportunity cost to vessel allocation. The process begins when a vessel becomes open. At that point, the relevant question is not "what rate can I get?", but "what options does this ship have from this position and time?" From there, the decision tree simplifies the choices into three paths: (i) fix a voyage now, (ii) ballast or wait to preserve flexibility, or (iii) take period employment to stabilise earnings.

The crucial step is the comparison box in the middle of the figure: evaluate each option on its commercial effect. The best option is the one that leaves the vessel in the strongest economic position once time, cost and risk are accounted for, not necessarily the one with the highest rate today. Once an option is chosen, the vessel is committed to that employment for the agreed period, so fixing now eliminates incompatible cargo options. Vessel employment is also a portfolio decision: the opportunity cost is the value of the best alternative forgone when one option is chosen over another.

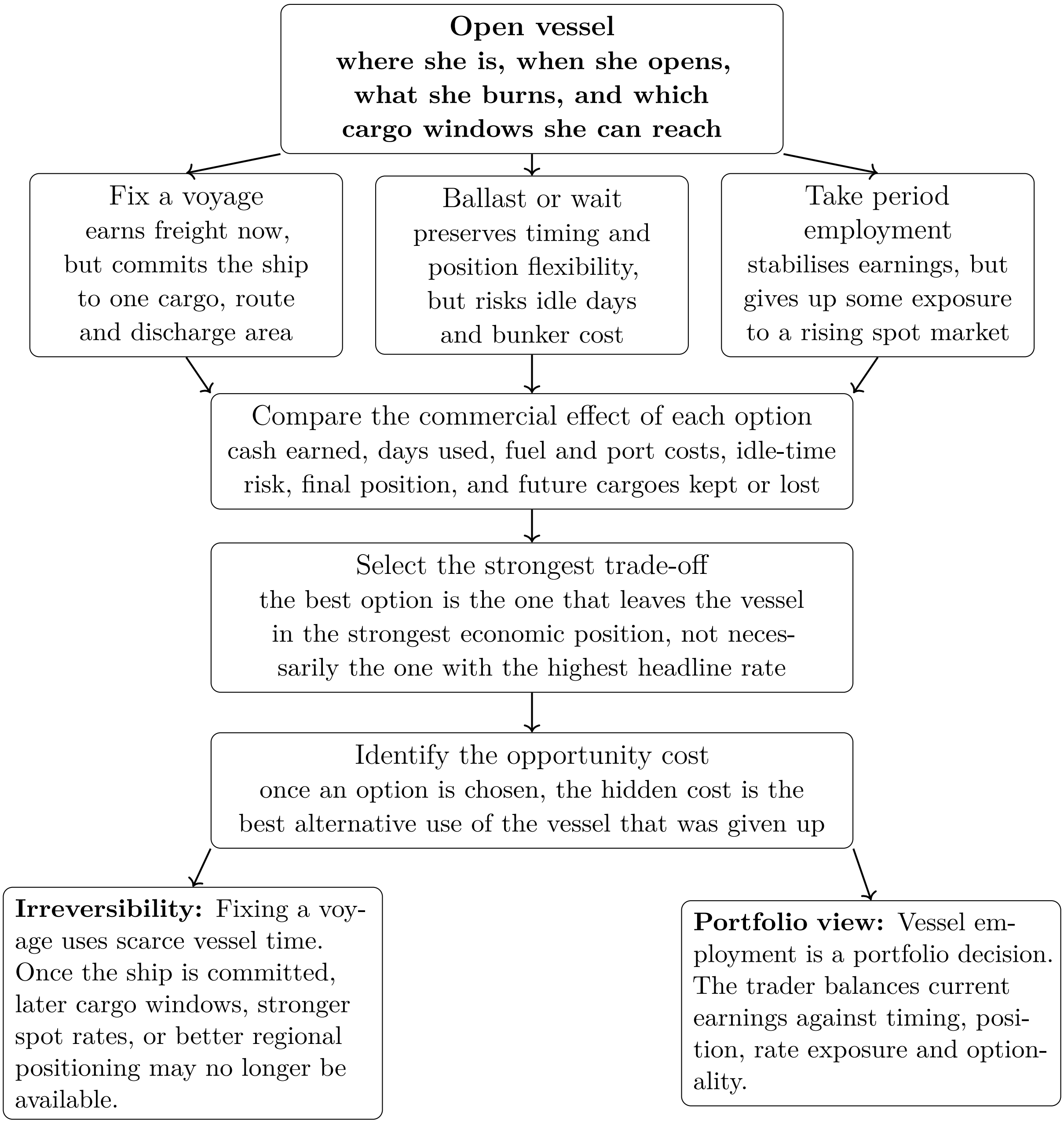



Figure 3.3: Opportunity cost in vessel allocation.

The three short examples below highlight one branch of the decision tree.

Example 1. A shipowner has a vessel underway with cargo loaded and a tight window before the next employment opportunity arises in the Pacific. The two main options are to sail faster (higher bunker burn) or slow steam (save bunkers but risk arriving too late). In the diagram's terms, this is a timing-driven version of the "ballast/wait" branch: you are paying for optionality in time. The opportunity cost of slow steaming is the foregone earnings from missing the stronger employment; the opportunity cost of slow steaming is the net value of the stronger employment that may be missed. The additional bunker consumption is a direct cost of speeding up, while the opportunity cost of speeding up is the net value of the slow-steaming alternative forgone. The correct comparison is the net commercial effect of both paths, including direct costs, risks and the value of the rejected alternative.

Example 2. After discharge in the Mediterranean, the owner can pursue prompt European employment (fix now), or reposition to East Coast South America (ECSA) (ballast) where expected income is higher over a two-trip horizon but requires a longer ballast leg and greater timing risk. The "fix now" branch offers faster cashflow and lower uncertainty; the "ballast" branch offers higher expected value but higher exposure to the risk that the market shifts while you are out of position. For comparison, you must compare days used, ballast cost, likely idle time, expected revenues across the scenario, and the final position left after the trade. The opportunity cost of choosing Europe is the expected revenue (net of ballast and risk) you forgo by not entering ECSA; the opportunity cost of choosing ECSA is the safer, faster employment you give up—plus the possibility that you arrive into a softer market.

Example 3. If an owner expects the market to rise, they must choose between fixing period employment, remaining in the spot market or shaping exposure with FFAs. Fixing the vessel secures steadier income but limits upside if market rates rise. Selling FFA contracts against physical vessel exposure preserves flexibility in physical employment and reduces downside exposure, but limits upside if the market rises and introduces basis risk between physical earnings and the FFA settlement. Remaining spot leaves the owner fully exposed to market movements, for better or worse. The opportunity cost of each choice is the value of the best rejected alternative. The decision depends on the owner's market view and risk tolerance.

Figure 3.3 shows a disciplined decision making model where a vessel decision should be judged against the best rejected alternative, not only against the visible profit on the chosen fixture. To evaluate opportunity cost, a trader needs a view on what the alternatives are likely to pay. Without that, trading becomes guesswork. Traders are, in essence, researchers who monetise their beliefs by putting a monetary value on them, and letting the market validate the beliefs.

### 3.3.3 Game Theory

Freight and commodity trading decisions are rarely made in isolation. They are shaped through strategic interactions, where one trader's choice depends on their own constraints, what they anticipate counterparties will do and how they can leverage their positions in the supply chain. Game theory contributes this strategic perspective to trader fundamentals (Goolsbee et al., 2019). Building on market and price fundamentals, game theory adds a strategic layer that helps traders understand how markets work under uneven information, time pressure and shifting bargaining power. In practice, the outcome "price" is the result of a negotiated package of terms.

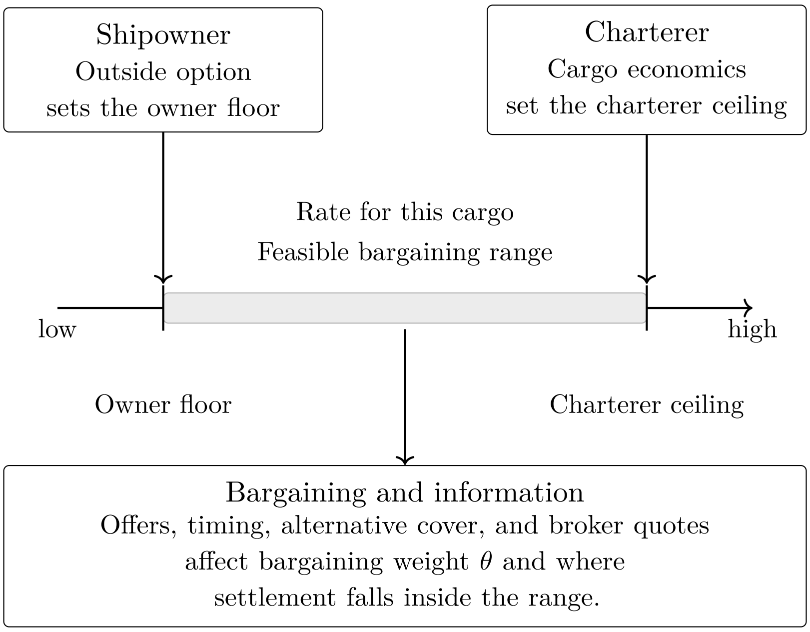



Figure 3.4: Stylised bargaining schematic for spot freight fixing.

Figure 3.4 captures the most common "game" in freight: bargaining in a spot fixture. Fixing does not occur at a single market point. Instead, it occurs inside a feasible bargaining range. The shipowner's outside option sets the floor, i.e. the lowest rate the owner can accept. The charterer's outside option sets the ceiling, i.e. the highest rate the charterer can pay before switching to an alternative. If the shipowner's alternative improves, the floor rises. If the charterer's alternatives improve, the ceiling falls. Either way, the feasible range moves and can tighten. Within that range, information and bargaining power determine where the deal lands.

A useful concept here is Nash equilibrium, which describes a set of strategies in which no player can improve their payoff by changing strategy unilaterally, given the strategies chosen by others. In a supply chain, a Nash equilibrium can be identified only after the relevant strategies and payoffs have been specified. In Figure 3.4, the owner's floor and the charterer's ceiling instead define the individually rational bargaining range. That range is not itself a Nash equilibrium, although a bargaining model with specified strategies and payoffs may have an equilibrium within it.

Game theory also illustrates the prisoner's dilemma, in which individually rational defection leaves both parties worse off than mutual cooperation. Repeated interaction, trust and enforceable agreements can support cooperation. The "sail fast, then wait" practice around tendering notice of readiness is better described as a contractual incentive or principal agent problem, unless the parties' strategies and payoffs are shown to satisfy the prisoner's dilemma structure. In that practice, the shipowner's incentive to tender notice early may differ from the shipper's or receiver's interest in reducing fuel use and waiting time.

Game theory therefore complements price fundamentals by explaining how freight is discovered through negotiation and interaction.

### 3.3.4 The Trading vs. Asset School

Facing the same market information, freight traders can develop very different ways of "seeing" the market. Two distinct approaches have emerged: a macro asset-oriented and a micro trading-oriented approach.

The asset-oriented school is defined by a macroeconomic approach, "asset heavy", emphasising global trends and long-term indicators such as global GDP growth, fleet utilisation and industry-wide metrics like scrapping rates, newbuild orders and fleet speed. Martin Stopford's work is a good example of this approach (Stopford, 2009). The central question is where the shipping cycle is headed and what it implies for earnings, asset values and capacity over years rather than weeks.

In contrast, the trading-oriented school adopts a more micro-level trading focus, "asset light" (TradeWinds News, 2019), concentrating on spot trading, transaction execution and highly responsive, short-term opportunistic decision-making. In this school, feedback and success are measured in weeks or months rather than years. This shorter feedback loop creates a positive cycle in which performance is quickly evaluated, allowing companies to adjust their strategies based on immediate outcomes. By honing in on specific transactions and optimising each transaction, the trading-oriented approach fosters a culture of continuous improvement and agility but at the expense of long-term decision making. Figure 3.5 shows the interaction between the two schools. Owners often charter out to traders when they prefer stable income or lack cargo access, while traders charter in from owners to obtain capacity without tying up capital. Those charter contracts are the "bridge" between the two schools: transferring commercial control of capacity while leaving ownership unchanged. Shipowners focused on assets earn from hire and asset value, while outfits focused on trading earn from execution, timing, access, spreads and optionality.

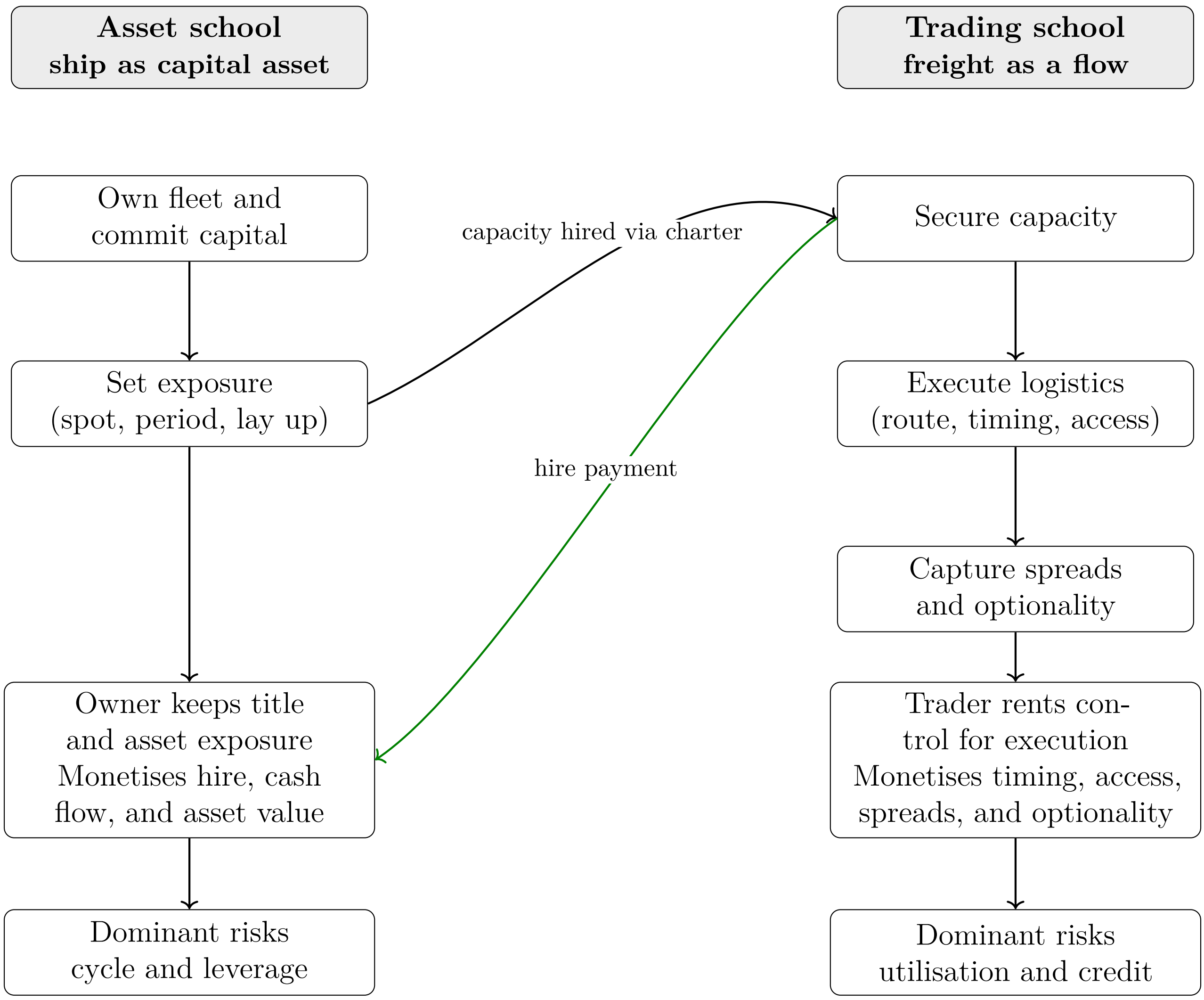



Figure 3.5: How freight control is separated from ship ownership.

While these distinctions are somewhat arbitrarily tied to national identities and countries, they reflect a broader divide in strategic orientation within one interconnected global shipping industry. Both aspects are important determinants of freight price, and traders must navigate both lenses: granular operational needs for a specific trade and broader macro fundamental trends. Therefore, these differences create an opportunity for traders to leverage insights from each approach, enhancing their adaptability in various market conditions.

## 3.4 Key Takeaways

- Economics provides the language for understanding freight price formation.
- Prices are signals that coordinate scarce resources under uncertainty.
- Opportunity cost is central to trading because every fixture implies the rejection of an alternative.
- The same freight market can be viewed through both a trading lens and an asset-allocation lens.

## 3.5 Connection to the Next Chapter

This chapter establishes the economic language of the book and the markets. The next chapter converts that language into a practical market-accounting tool by introducing balance sheets as a supply-demand framework used by real life traders.

# Chapter 4

# Balance Sheets

## 4.1 Balance Sheets

Traders form a view on whether to buy or sell in the market by analysing the supply vs. demand balance. In trading jargon, this is a *balance sheet*. It is not an accounting balance sheet that records the assets, liabilities and shareholders' equity of a company at a specific point in time. A trading balance sheet is a market accounting framework. It tracks available supply, expected demand, and whether conditions are tightening or loosening.

In commodity markets, traders track a small set of core variables: production, imports, exports, consumption, stocks and trade flows. Putting these pieces together gives a directional view of the market surplus or deficit. Because markets tend to clear locally before they clear globally, balance sheets are best treated as dynamic and regional. Weather conditions, government policies, and substitution can quickly shift the balance.

The same logic applies in freight markets, but "stocks" and "flows" are different. Freight traders do not track inventory directly. Instead, they track transport capacity through vessel positioning, congestion, fleet supply and tonne-miles demand for freight services. Figure 4.1 shows how commodity imbalances translate into the freight balance sheet. Commodity fundamentals determine a net trade requirement; that requirement becomes tonne-mile demand for shipping services. Freight rates then clear transport demand against open tonnage and the marginal ship's reservation level.

Tonne miles equal cargo metric tonnes multiplied by sailing distance. The math is simple: cargo mt multiplied with sailing miles equals tonne-miles (Stopford, 2009). For a 60,000 mt Panamax soybean cargo to Shanghai, a Santos voyage of roughly 12,500 miles generates about 750 million tonne-miles, while a Pacific Northwest voyage of roughly 5,700 miles generates about 342 million. The Brazilian cargo therefore creates more than twice the transport demand despite moving the same volume. The longer haul occupies the vessel for more days, delays its next open position and absorbs fleet capacity. Freight balance sheets should therefore track changes in sourcing patterns, not merely aggregate soybean exports, because origin determines effective demand for ships.

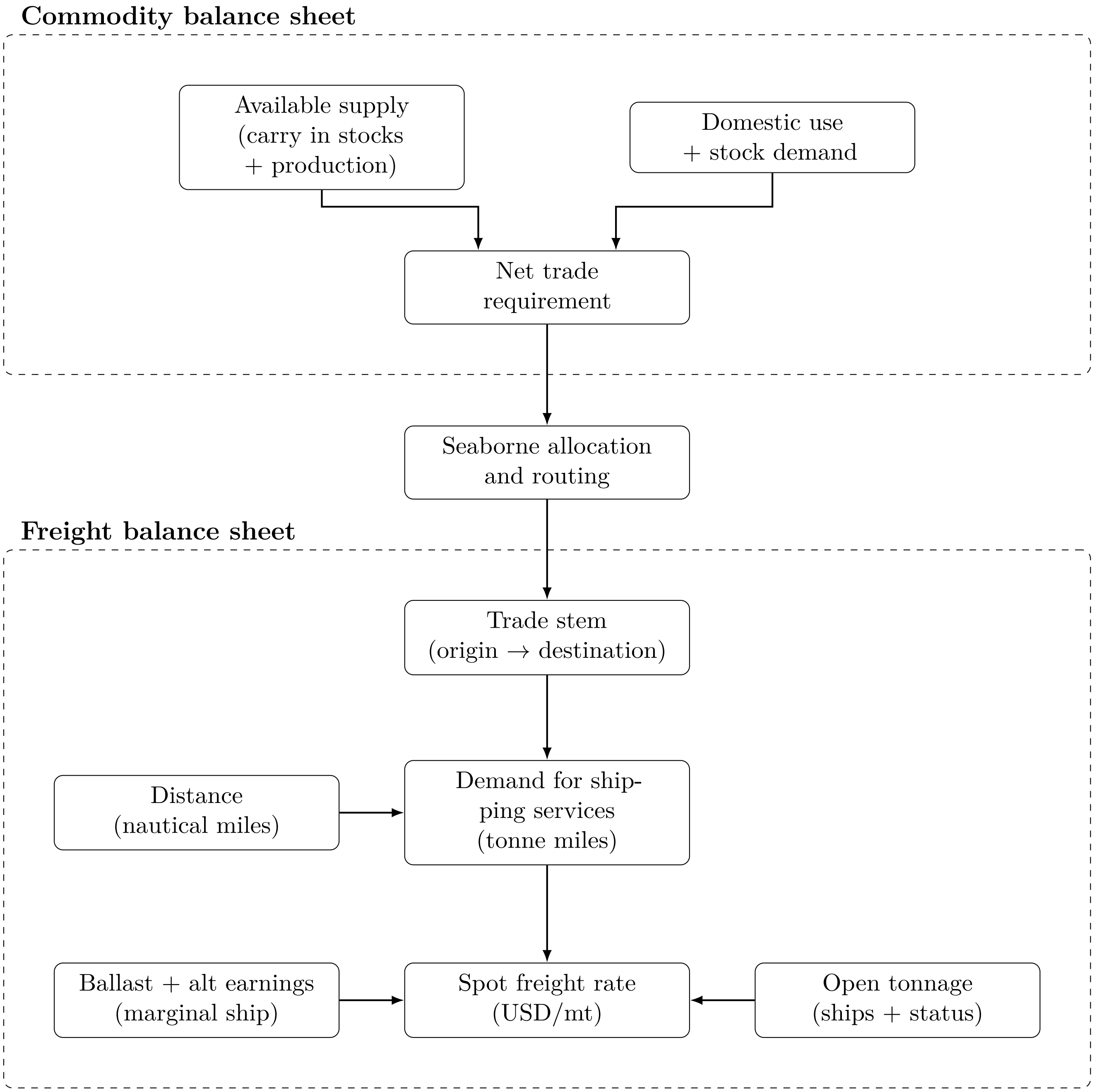



Figure 4.1: From commodity fundamentals to freight clearing. Commodity fundamentals determine net trade requirements, which are translated into seaborne allocation and routing, trade stems, and demand for shipping services measured in tonne miles. Freight rates then clear transport demand against open tonnage and the marginal ship's reservation level.

The purpose of this chapter is to make the balance sheet logic transferable. The goal is not perfect forecasting, but disciplined forecasting based on market intelligence: to be consistently less wrong than the market and to understand which variables drive outcomes under different regimes. Once we foresee a tightening or loosening market, the next step is translating that view into price expectations and managing the associated risks.

### 4.1.1 Balance Sheets in Commodity Trading

In commodity trading, a balance sheet is a structured accounting of physical availability over a defined period, typically a marketing year. Traders track inflows (beginning stocks, production and imports) against outflows (domestic consumption and exports), with ending stocks as the residual.

The inflow side and the outflow side are driven by different forces. Commodity demand also changes over different time horizons. Cyclical demand reflects short-term movements caused by price changes, income conditions or inventory behaviour. Structural demand reflects medium-term shifts in consumption patterns, processing capacity, trade policy or substitution. Secular demand reflects long-term forces such as population growth, economic development and dietary change (Ahn, 2019). For balance sheet work, the practical question is how these demand shifts affect domestic use, imports, exports and ending stocks.

Agricultural products have features that make their balance sheets different, adding a further complication to the balance sheet. Agricultural supply is biological and seasonal. Before planting, farmers decide how many acres to dedicate to each crop based on competing crop prices and pre-plant weather conditions. These decisions set the baseline production potential. After planting, supply becomes difficult to adjust in the short run and outcomes depend largely on yields, with post-plant weather often the dominant driver. Government policies matter too: price guarantees, subsidies and crop insurance programmes can affect incentives and shift planting decisions across crops.

Many agricultural commodities are both seasonal and storable, with inventories acting as a buffer that absorbs shocks and determines how tight the market becomes. Balance sheets are therefore organised around the marketing year, starting with the first month of harvest and ending with the following year's harvest and typically segmented by commodity type, country and region (Nijs, 2014). Forecasting begins nearly a year in advance, incorporating both northern and southern hemisphere production to account for global supply variations. It is worth noting that even with careful accounting, uncertainties remain: demand can shift, trade policies can alter and stock information is often reported with a lag, leading to ongoing market speculation and potential price volatility.

The structure described above is easiest to see in grains such as wheat, corn or soybeans. However, commodity markets are not uniform. Differences in production cycles, quality specifications and seasonality can require a different accounting structure even when the underlying logic is the same. To highlight this, the next subsection introduces sugar, an important bulk commodity with a very different market structure.

### 4.1.2 Sugar vs. Grain Balance Sheets

Unlike most grains, sugar production is spread more evenly throughout the year and is heavily influenced by the southern hemisphere, which accounts for about 60% of the world's raw sugar exports (Kingsman, 2000). As a result, sugar balance sheets are often built as a 12-month flow analysis rather than through a single crop-year snapshot. Practitioners often break the year into quarters or months to maintain a more nuanced understanding of supply and demand dynamics.

Sugar also requires analysts to be explicit about quality. The market differentiates between raw sugar and white sugar, requiring quality conversions and adjustments based on factors such as polarisation and local definitions. For example, raw sugar often needs to be converted to a standard polarisation level, adding another dimension to the data analysis.

On the supply side, sugar production has a process called ratooning, in which sugar cane regrows after harvest, allowing multiple harvests before replanting. This ratooning therefore introduces longer-term supply cycles (six to eight years); consequently, the supply response to price signals can play out over multiple seasons rather than within a single year.

The practical takeaways are not that sugar is "harder" than grains but that the same balance sheet logic must be implemented differently. Compared with grains, sugar balance sheets tend to be more sensitive to timing and to quality and they often require more conversion work to harmonise data across sources. In addition, analysts must integrate data from multiple countries with differing reporting standards and account for seasonal and cyclical production factors unique to sugar.

### 4.1.3 Balance Sheets in Freight Trading

In freight markets, traders often estimate effective supply from open tonnage adjusted for speed, congestion, port turnaround time and idle days. Transport demand is measured by cargo volumes and the tonne-miles required to move them. However, the freight balance sheet is rarely "global supply vs. global demand." It is a matching problem: corridor-specific transport demand must be met by the right pool of ships in the right place at the right time.

A practical way to structure this matching problem is by vessel segment because each segment competes in a different arena and clears on different information sets. For example, Capesize vessels operate in a largely global market, dominated by long-haul iron ore and coal flows that link major exporters such as Brazil and Australia with demand hubs in Asia. Panamax vessels, sized to pass through the Panama Canal, typically clear more at the basin level, moving commodities such as grains and minerals within the Atlantic and Pacific basins, often servicing routes between continents but within specific oceanic regions.

Smaller vessel classes provide greater regional and port flexibility. Supramax vessels trade globally but are particularly useful on regional and interregional routes, carrying cargoes such as fertilisers, cement and grains. Their size allows them to call at a wider range of ports than larger bulk carriers. Handysize vessels offer even greater flexibility, serving smaller ports, niche routes and fragmented cargo programmes that larger vessels cannot access efficiently. Each vessel segment therefore has its own balance sheet although there are overlaps: demand is shaped by relative prices between vessel sizes, cargo volumes, parcel sizes and timing requirements, while supply depends on the number of suitable vessels that are commercially open and correctly positioned. Consequently, one vessel segment or region can tighten while another remains well supplied. Where operationally feasible, freight buyers may respond to relative freight costs by dividing cargoes into smaller parcels or switching between vessel classes.

### 4.1.4 Forecasting with Balance Sheets

For traders, forecasting freight rates and market conditions is a necessity to compete. Every decision; whether to charter a ship, order a new vessel, or divest an existing asset, relies on the view of future conditions (Stopford, 2009). The purpose of the balance sheet, however, is not to predict the rate. It is to translate scattered signals and indicators into a disciplined view of tightening or loosening and to update that view quickly when market changes.

Balance sheets do this by imposing a clear structure at the level where freight markets actually clear. They break demand down into corridor and segment-specific cargo types and translate volumes into tonne-mile requirements. For instance, these balance sheets model individual countries' seasonal demand for specific cargo types, account for regional crop cycles and track the precise location and status of ships to match demand with shipping capacity in near real-time. This approach is valuable because shipping forecasts have a poor record when they are treated as precise point predictions. In freight trading, the edge comes from sharper real-time monitoring, which makes balance sheets more suitable for operational decisions in commodity supply chain logistics. A good balance sheet is therefore a living model, simple enough to update daily, but structured enough to capture the market dynamics.

Traditional cycle indicators still matter as context. Fleet growth, scrapping, speeds, and global trade growth help define the background regime and the plausible range of outcomes over time (Stopford, 2009). But the balance sheet lens is what turns that backdrop into an actionable trading map by identifying where the market clears in practice: specific corridors, specific segments, and specific timing constraints.

### 4.1.5 Foreign Exchange

Foreign exchange (FOREX) dynamics are central to commodity trading and therefore freight trading. From a balance sheet perspective, FOREX is one of the variables that can move the trade flows from one origin or destination to another. FOREX rarely alters production or the harvest itself, but it changes the local currency economics of selling into a market priced in USD and thus the competitiveness of an exporter's offer. That shift affects who becomes the marginal exporter, how quickly an origin sells and where cargoes are routed. In other words, FOREX moves the balance sheet by changing the pace at which a surplus clears and the direction in which trade flows move.

Consider a European commodity trader exporting grain to Asia under contracts priced in USD. If the EUR strengthens against the USD, the EUR value of the trader's USD receipts falls. In this case, margins tighten, the trader's incentive to sell weakens and flows may shift to alternative origins with more favourable currency economics. These FOREX-driven changes appear directly in the balance sheet through exports and feed into the freight balance sheet by changing volumes, corridors and tonne-mile demand.

FOREX becomes most operationally binding when trades are executed on CFR terms because the trader is managing a combined position across commodity, freight and currency. Under CFR, the delivered price is committed, while the FOB goods and freight must be secured and the derivative positions executed before the combined position can be considered hedged.

Figure 4.2 shows the working-capital and liquidity cycle in a CFR trade. The first band shows the commercial cash sequence, the second the bank-finance sequence, and the third the hedge-liquidity sequence. Under a letter of credit, cash is committed when the seller purchases the FOB cargo and fixes or pays freight, but payment for the cargo is normally released once the bank has received and checked a complying presentation of clean documents evidencing shipment on board. The cash cycle is therefore much shorter than the physical voyage. Under CAD, documentary collection, LC or open-account terms, however, the seller's credit exposure may continue until buyer payment or maturity. The balance sheet issue is therefore not only the physical cargo value, but the timing mismatch between purchase finance, freight payments, LC proceeds and hedge liquidity. Futures, FFAs and FOREX hedges may require initial margin, variation margin or collateral before trade cash is received. A profitable trade can therefore still become liquidity-constrained if bank lines, margin calls or collateral requirements exceed available headroom.

Traders manage FOREX risk with standard instruments such as forwards, options and swaps. For example, a European trader selling in USD can use a forward to lock a EUR/USD rate and stabilise the EUR value of expected sales proceeds. FOREX hedging therefore not only secures margin; it also helps keep the export programme executable and the cash cycle stable. FOREX interacts with the other two pillars of a CFR offer: FOB and freight. FOB is influenced by local cost structures and the local currency; freight is driven by corridor-specific vessel supply and tonne-mile demand. When currencies, FOB, and freight move in the same direction, pricing pressure compounds. A strong EUR alongside rising freight, for example, can compress delivered margins quickly and force the trader to re-price, re-route, or delay execution. For balance sheet work, the key is that these pressures do not remain "financial."

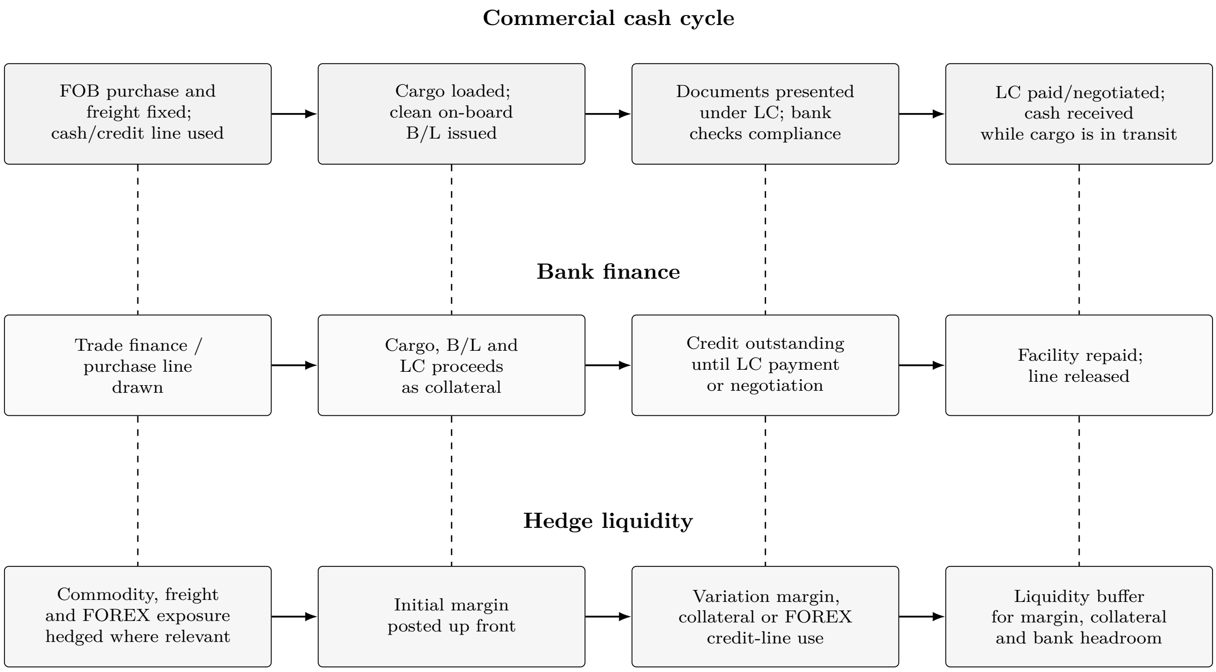



Figure 4.2: Working capital and liquidity in a CFR trade under a sight letter of credit. Solid arrows show the sequence within each band. Dashed links show dependencies across the commercial cash cycle, bank finance and hedge liquidity. Payment timing differs under CAD, usance LC and open-account terms.

Research shows (Bermpei et al., 2024) that exchange rates of commodity-exporting countries, often termed "commodity currencies," are influenced not only by individual commodity prices but also by uncertainty across a basket of commodities. An increase in global commodity price uncertainty triggers short-term depreciation in the effective exchange rates of commodity currencies, followed by a medium-term recovery. This pattern is specific to commodity currencies and is not observed in benchmark currencies such as the EUR and USD. The cited study finds that the EUR tends to be neutral to such shocks, while the USD acts as a typical safe-haven currency during periods of market volatility. This phenomenon, termed the "commodity uncertainty currency" property, highlights how commodity price volatility impacts exchange rate dynamics in exporting countries. The findings underscore the sensitivity of commodity currencies to global commodity price shifts, especially during periods of heightened uncertainty.

## 4.2 How Balance Sheets Shape Prices

The previous section introduced the balance sheet as a way to form a view of the market. This section decomposes the balance sheet and shows how those factors work in freight trading. Figure 4.3 summarises the structure in two layers. The macro horizon provides the reference level, while the regional horizon determines the spot route rate. The gap between them is the route basis. In practice, the freight trader's task is to identify whether the regional balance sheet differs from the broader market reference and whether that difference is already reflected in price.

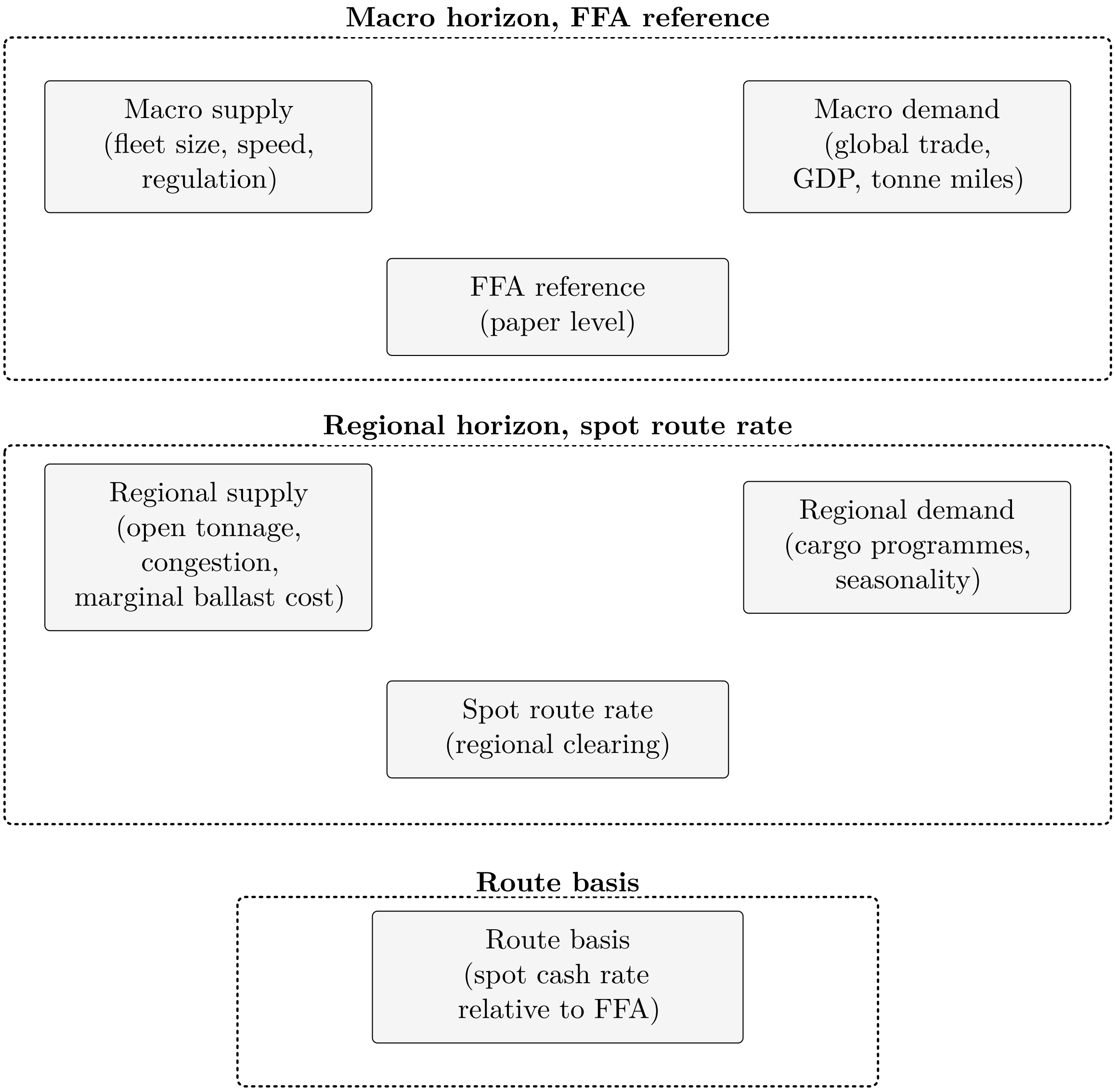



Figure 4.3: Freight formation as a comparison between two outputs.

### 4.2.1 Macro Horizon Inputs

Macro inputs provide the reference layer of the freight balance sheet. They do not usually determine which ship fixes the next cargo, but they help explain the broader level reflected in FFA pricing. In this sense, the macro layer is not the final trading answer; it is the benchmark against which the regional balance is compared.

On the supply side, the relevant macro inputs include fleet size, newbuilding orders, scrapping, vessel age, average speed, regulation and technical efficiency. These variables shape the potential transport capacity available to the market. Shipping supply changes slowly because vessels take years to build, so macro supply is more stable than agricultural production. However, small differences in fleet growth can still matter over a cycle, especially for shipowners and investors making long-term asset decisions. Macro supply is not only a question of how many vessels exist, but also how efficiently that fleet can operate. Average speed, technological efficiency and regulation all affect the effective transport capacity available to the market. Global shocks such as geopolitical tensions, pandemics and environmental rules can further alter the macro balance by changing fleet deployment, operating costs or the retirement profile of older ships.

On the demand side, the main macro inputs are global trade, GDP growth and industrial production, which together shape commodity demand. The seaborne share of that demand generates cargo volumes, which become tonne-mile demand once distance is included. Traders may take positions based on expected freight demand through buying and selling of FFAs, COAs or period tonnage. Tonne-mile demand is an especially important metric because it combines volume and distance. A rise in commodity volume does not affect freight equally across all routes. One tonne shipped across oceans creates more vessel demand than one tonne moved within a nearby region. Policy and structural shifts also enter the macro demand layer. Tariffs, trade agreements, environmental regulations and sustainable preferences can change the volume, direction and distance of trade flows. For example, a shift in soybean sourcing due to tariffs can change panamax tonne-mile demand even if total demand is unchanged.

The macro inputs define whether the broader freight market is priced for stronger or weaker utilisation, but the trader must still test that reference against the regional balance: which cargoes are appearing, where they are going, and which ships they require.

### 4.2.2 Regional Horizon Inputs

While the macro layer provides the reference level, the regional layer tests whether that reference holds for a specific corridor, vessel segment and shipment window.

On the supply side, the main regional input is effective open tonnage. It is the number of commercially available ships that can meet a cargo's shipment window within specific geographic areas. In addition to availability and position, operational factors such as vessel draft, emissions compliance, speed and status (laden, in ballast or idle) also affect effective capacity. A ship may exist in the global fleet but still be irrelevant to a specific cargo if it is too far away, already committed, or unsuitable for the port.

This is why spatial distribution matters more than the macro metrics such as order books and fleet size. A global fleet may look balanced while one basin is tight and another is oversupplied. For instance, a concentration of ships in the Pacific with a scarcity in the Atlantic can lead to favourable rates for owners in the Atlantic, while owners in the Pacific may face diminished rates. Automatic Identification System (AIS) can help traders monitor vessel locations and movements (Adland, 2021). A theoretical comparison of current AIS ship counts with historical averages could, for example, show the following:

- Handysize vessels are evenly distributed across regions, with a lower than seasonal average for ECSA.
- The ratio of Supramax ships in the Pacific versus the Atlantic remain relatively stable, although there is a noticeable incrase in ships on the West Coast AMericas.
- Panamax vessels in the Atlantic are significantly below the historical average, with 18% fewer ships than usual.

These patterns help traders to make informed decisions to optimise vessel positioning and capitalise on regional rate differentials. Nevertheless, AIS data must be interpreted carefully because of data noise and the difficulty of distinguishing between laden ships, ballast voyages and transient movements. Data providers sell clean data, but this comes at a premium price.

On the demand side, regional inputs are cargo programmes, which are shaped by local production, industrial activity, trade relationship and seasonality. For instance, China's steel sector drives substantial demand for geared ships, while resource-rich areas like South America require bulk carriers for transporting minerals and agricultural products to China. Agricultural exports often peak around harvest windows, while industrial flows depend on local output, processing margins and import demand. Regional policies, infrastructure constraints and port capacity can also affect whether cargoes move smoothly or are delayed.

For balance sheet work, the key is to translate these regional drivers into measurable indicators covering monthly or weekly volumes. A South American balance sheet might track exports of iron ore, steel products, corn, soybeans and sugar using historical data and forecasts, while also assessing which Handysize, Supramax or Panamax vessels are suitable and commercially open. The trader's task is to identify an imbalance between cargo demand and effective open tonnage before it is fully reflected in price.

### 4.2.3 Route Basis

Route basis is the difference between the regional spot route rate and the broader macro reference. It appears when the local supply-demand balance diverges from the broader market. If a regional balance tightens faster than the macro market recognises, the spot route may strengthen relative to the reference level. If local tonnage is abundant while broader market remains firm, the route may trade at a discount.

The balance sheet question is therefore not simply whether the basis is high or low, but what local supply or demand condition is causing the regional route to trade away from the macro reference. Basis also matters because it can trigger adjustment. Higher regional rates may attract ballast tonnage from other basins, while also testing cargo demand through delayed shipments, origin shifts, parcel-size changes, or vessel-class substitution. These responses can narrow or widen the gap over time, which is why the balance sheet must be updated continuously.

When freight rates in Region A increase significantly, it becomes economically attractive for shipowners in Region B to send their vessels to Region A, even after considering the additional ballast costs. This price-driven movement ensures that ships are allocated to regions with higher demand, optimising fleet utilisation and maintaining market equilibrium. By incorporating ballast costs, freight rates effectively incentivise shipowners to respond to regional disparities, allowing the global fleet to adjust dynamically to shifting economic conditions.

Freight demand can adjust through reallocation, substitution and, in some cases, genuine demand destruction. If a commodity becomes cheaper to source from Region B than from Region A, buyers may change origin. This reduces freight demand on routes from Region A but increases it elsewhere; depending on voyage distance, it may also increase or decrease total tonne-mile demand. Buyers can also alter parcel sizes or switch vessel classes when relative freight rates, port restrictions and cargo availability make another option more economical. For example, a buyer may replace one Panamax shipment with several Supramax shipments, shifting demand between vessel segments without necessarily reducing aggregate cargo volume. Genuine demand destruction occurs when freight costs make the underlying commodity trade uneconomic, causing shipments to be delayed, reduced or cancelled. This lowers the quantity of freight demanded at prevailing rates and may reduce freight rates and fleet utilisation, but it does not necessarily represent a permanent shift in the demand curve.

The interplay between supply creation and demand destruction ensures that freight markets remain responsive to both global and regional economic conditions and also makes modelling a repeat task. Shipowners must continuously monitor supply, demand *and* price signals to adjust their fleet deployment strategies to align with market demands, while freight buyers navigate cost pressures and sourcing decisions that influence their freight needs. Figure 4.4 shows why freight rates can rise sharply near capacity: quantity adjusts only modestly once spare fleet capacity is exhausted.

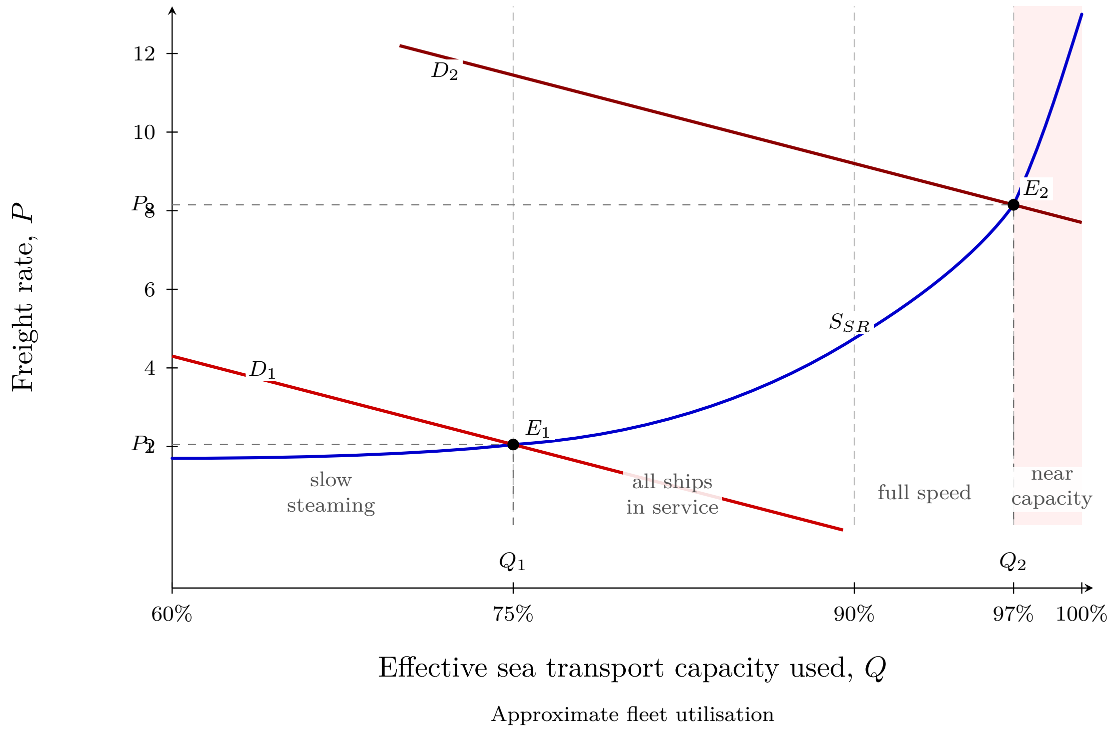



Figure 4.4: Short run fleet supply is relatively flat at low utilisation and steep near capacity. As demand rises from $D_1$ to $D_2$, equilibrium moves from $E_1$ to $E_2$. Quantity increases modestly, from $Q_1$ to $Q_2$, but freight rates rise sharply, from $P_1$ to $P_2$, because spare capacity is limited.

### 4.2.4 The Trading Opportunity Framework (TOF)

An analyst's job is not only to understand markets but also to formulate trading ideas that a trader can price, hedge and execute. There exist no formal education nor model to do this right. It is about communicating the essentials so that the trader can easily grasp what the opportunity for a trade is, and how the mechanics of it works. The Trading Opportunity Framework (TOF) below is a novel five-step framework for turning an opportunity into a trading plan, but given the flexibile nature of the written word, it can easily be amended to include extra steps if deemed necessary:

1. Opportunity

The first step in capitalising on any trading opportunity is to clearly define what the opportunity entails, i.e. which relationships are "off". This involves a thorough analysis of the market conditions, identifying anomalies that present a trading opportunity. For instance, in the freight market, an opportunity might arise from an unexpected surge in demand for shipping routes between specific ports due to geopolitical events, a bumper harvest or economic shifts. By precisely outlining the nature of the opportunity traders can focus their efforts on strategies that leverage these unique market conditions, ensuring that their actions are targeted and effective.

2. Hedging

Once the opportunity is identified, it is crucial to isolate it from unrelated exposure to ensure that potential gains are not offset by unforeseen adverse movements. An example would be a basis trade (in freight markets, this would involve selling a physical voyage and buying FFAs) in which the analyst expects the basis to narrow. Hedging out extra risks such as emissions, currency and fuel price risks reduces the overall risk of the venture. By mitigating these ancillary risks, traders can maintain a clear focus on the primary opportunity, enhancing the likelihood of realising the expected returns.

3. Risks

Every trading position carries inherent risks and it is essential to anticipate events that could render the opportunity unfavourable. Traders must develop robust exit strategies to protect their investments in case the market dynamics shift unexpectedly. This involves identifying specific triggers that would prompt an exit, such as significant changes in demand, geopolitical instability or adverse weather conditions affecting shipping routes. As soon as the trade is in the book, the risk management process starts.

4. Profit and Exit

Traders must evaluate how far a trade can go, whether in their favour or against them. If, by day three, the market has moved significantly beyond expectations, it may be time to take profit. However, trading is inherently dynamic, requiring traders to regularly reassess their strategies. A prudent trader outlines plausible scenarios and continuously revisits them, adapting to changing market conditions.

Exit strategies are equally vital. Traders must consider the anticipated costs of exiting a position, including transaction fees or potential losses. Being aware of these factors allows traders to make informed, prompt decisions, thus minimising the negative impact on their portfolio. Exit strategies should not be static; they must evolve alongside market conditions to safeguard profits and manage risks efficiently.

5. Execution

The final component of capitalising on a trading opportunity is the execution strategy, which outlines how the trades will be implemented to achieve the desired outcomes. This involves determining the timing, scale and methods of entering and exiting positions to optimise performance. For instance, in the freight market, an execution strategy might include a go-to-market strategy of using shipbrokers, utilising real-time data to adjust positions based on market feedback and employing automated indicators to be able to respond swiftly to changes. A well-crafted execution strategy ensures that the theoretical opportunities are translated into practical actions, allowing traders to efficiently manage their portfolios and achieve sustained profitability.

## 4.3 Key Takeaways

- A balance sheet is a disciplined way of organising market evidence, which will help increase the odds of making the right predictions, but it is not a prediction machine on its own.
- Freight balances differ from commodity balances because freight is a transport service rather than a storable physical good. This distinction changes the economic fundamentals of trading freight markets.
- Regional tightness, global demand and global fleet conditions must be analysed together as everything is connected by price.
- Good analysis requires both numerical structure, clear written judgement and communication skills.

## 4.4 Connection to the Next Chapter

Balance sheets identify where the market may be tight or loose. The next chapter explains *where* that value comes from in the first place: transformations in space, time and form.

# Chapter 5

# Space, Time and Form

Chapter 4 introduced balance sheets as a way to understand the supply and demand balance in the market. A balance sheet can show the market imbalance, but it does not automatically create profit. The trader's next task is more practical: transform this market imbalance into a margin.

A commodity trader rarely earns a margin simply by buying and selling the same product in the same place at the same time. Value is created by transformation: moving a commodity from surplus to deficit regions, holding it from periods of abundance to periods of scarcity, or changing its quality, specification or contractual form so that it better fits buyer demand. This is the practical heart of physical commodity trading and the same logic applies in freight trading. This leads to the core of this chapter: the transformation margin.

## 5.1 The Transformation Margin Framework

Transformation margin provides a practical framework for deciding whether a trader should act on a market imbalance. **Expected transformation margin = value after transformation - value before transformation - execution costs - risk allowance**

The formula captures the commercial logic behind many physical trading decisions. It asks whether the trader can improve a position enough to justify the cost, time and risk required to do so. ***Value after transformation*** is the expected value of the physical position after the trader has changed it. This could be the value of grain delivered to an import port, the value of a cargo sold later in the season, or the earnings of a vessel after repositioning into a stronger freight market. ***Value before transformation*** is the current value of the position. This may be the origin cash price of the cargo, the value of the cargo in its current quality or the current employment value of a vessel. ***Execution costs*** are the costs required to complete the transformation. In commodity trading, these may include freight, storage, finance, insurance, blending, inspection and port charges. In freight trading, they may include bunkers, ballast costs, waiting time, commissions and the opportunity cost of using a vessel on one route rather than another. ***Risk allowance*** is the margin a trader requires in case execution conditions change or other problems arise before the trade is complete. A cargo may fail specification. A buyer may delay payment. The risk allowance is the extra margin a trader requires to justify these uncertainties.

The formula bridges market diagnosis and physical trading, and therefore can be read as a decision rule. It prevents the trader from looking only at the headline price difference. Before committing capital, the trader must ask: Is the expected value gained from transformation greater than the full cost and risk of making the transformation?

The transformation formula can be applied through space, time and form. They are the three practical levers through which traders turn a market imbalance into a more valuable commercial position, thus creating value. Space refers to location: a commodity or vessel may be worth more in one place than another. Time refers to timing: a cargo, freight exposure or vessel position may be worth more in a future period than today. Form refers to the physical, contractual or commercial shape of the position: the same underlying commodity or freight exposure may have a different value once its quality, specification, delivery terms or contract structure changes. Despite the logic remaining the same, each lever has its own formula variation of transformation margin:

- Space transformation margin = destination value - origin value - transport and logistics costs - risk allowance
- Time transformation margin = future value - current value - carrying costs - risk allowance
- Form transformation margin = adjusted value - original value - processing and operational costs - risk allowance

## 5.2 Transformation in Commodity Trading

Space transformation refers to reallocating commodities from regions with surplus to areas with shortage. Commodity production is geographically concentrated and often distant from urban centres where demand is dispersed. Bridging this imbalance requires efficient logistics to move wheat from farms to mills and markets. This spatial adjustment is crucial for the functioning of the supply chain and the global food economy. Traders and logistics providers coordinate this movement, optimising routes and managing transportation costs. By coordinating freight, traders also transform regional imbalances into arbitrage opportunities. Moving commodities is what freight is about, hence this section will be short as the rest of the book should cover all the necessary challenges and opportunities in freight trading. Commodity trading is essentially a transformation business. Traders create value by using one or more types of transformations. When these transformations are used to capture a price difference between two physical conditions of the commodity, the activity can be understood as physical arbitrage (Pirrong, 2018).

Figure 5.1 frames physical arbitrage as an ongoing three-dimensional optimisation problem across space, time and form. The trader's core task is to choose the combination of location, timing and form that maximises net margin.

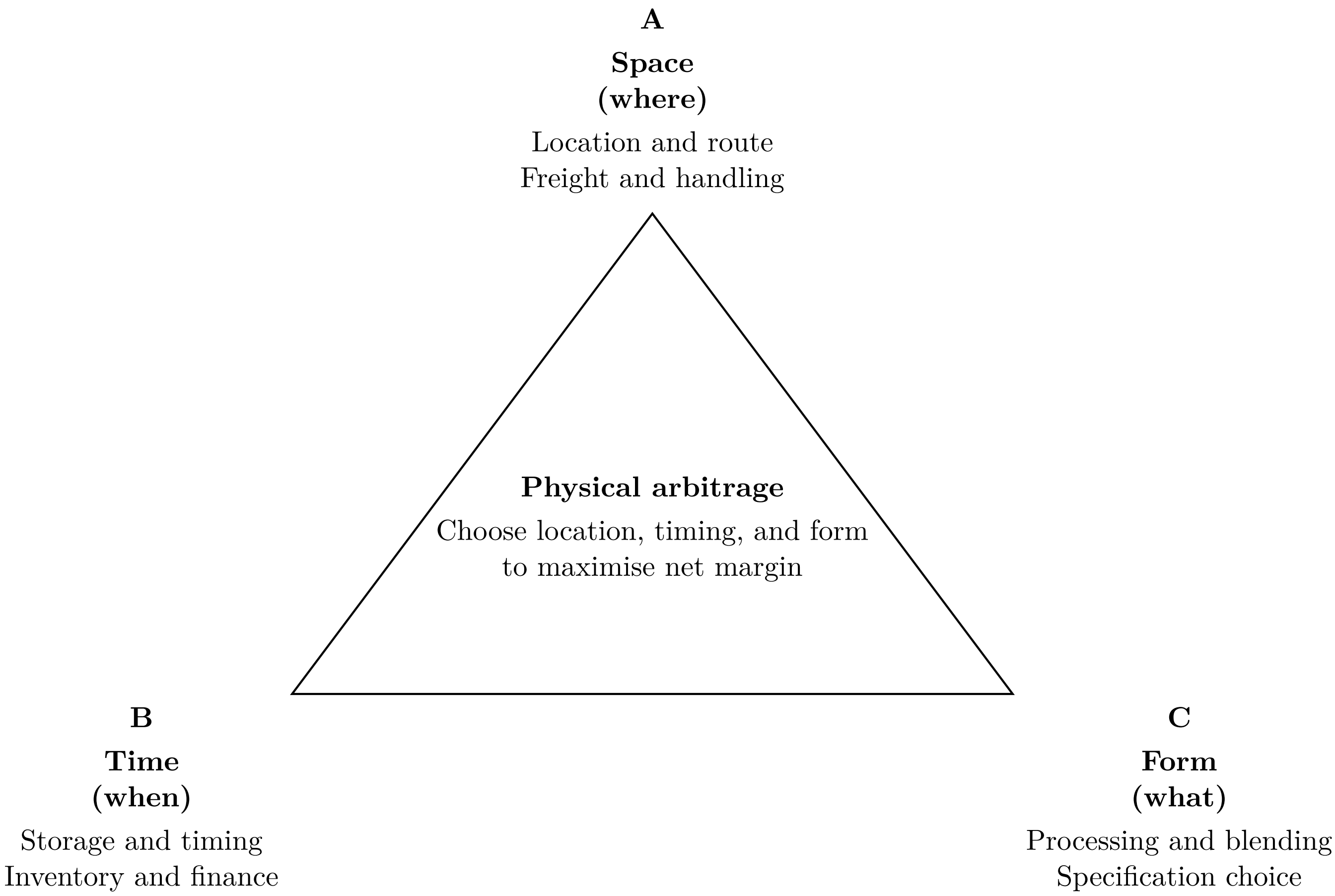



Figure 5.1: Space, time, and form in physical commodity arbitrage

### In Space

Space transformation in commodity trading is about whether a geographical price spread can be physically captured. A commodity is generally and logically cheaper in a surplus origin and more expensive in a deficit consumption region, but the spread is only tradable if the cargo can be moved through the required supply chain (Nijs, 2014). For grain, this may mean moving wheat from inland farms to mills or export markets. For energy commodities, it may mean moving biomass, coal or crude oil from production areas or refineries to regions where demand is. The commodity trader's task is to examine whether the price spread is large enough to cover transport and logistics costs, as well as execution risk. If so, they will coordinate this movement, optimising routes and managing transportation costs.

### In Time

Time transformation in commodity trading is about deciding when a physical commodity should be released into the market. Many commodities are produced or harvested in uneven flows, while consumption is more continuous. For example, wheat harvests occur seasonally, often once a year, but its consumption is continuous throughout the year.

Storage gives traders flexibility over when inventory enters the market. Instead of all production being sold immediately when it is harvested or produced, part of the flow can be held back and released later according to market conditions. In this sense, storage works like a tap: traders can slow or increase the release of inventory in response to prices, demand, logistics constraints and expectations about future supply. This is how storage links today's spot market with the market of the future, by continually comparing the value of selling now with the value of carrying inventory forward.

This is especially important for storable commodities such as wheat, corn, soybeans, peanuts, crude oil and natural gas. The trader's decision is not simply whether storage is available, but whether storage is profitable. Holding inventory ties up capital and creates storage costs, financing costs, handling costs into and out of storage, insurance costs and quality deterioration risk (Geman, 2015). For grain, this may also include shrinkage or moisture problems. For oil and refined products, tank availability and financing cost can become key binding constraints.

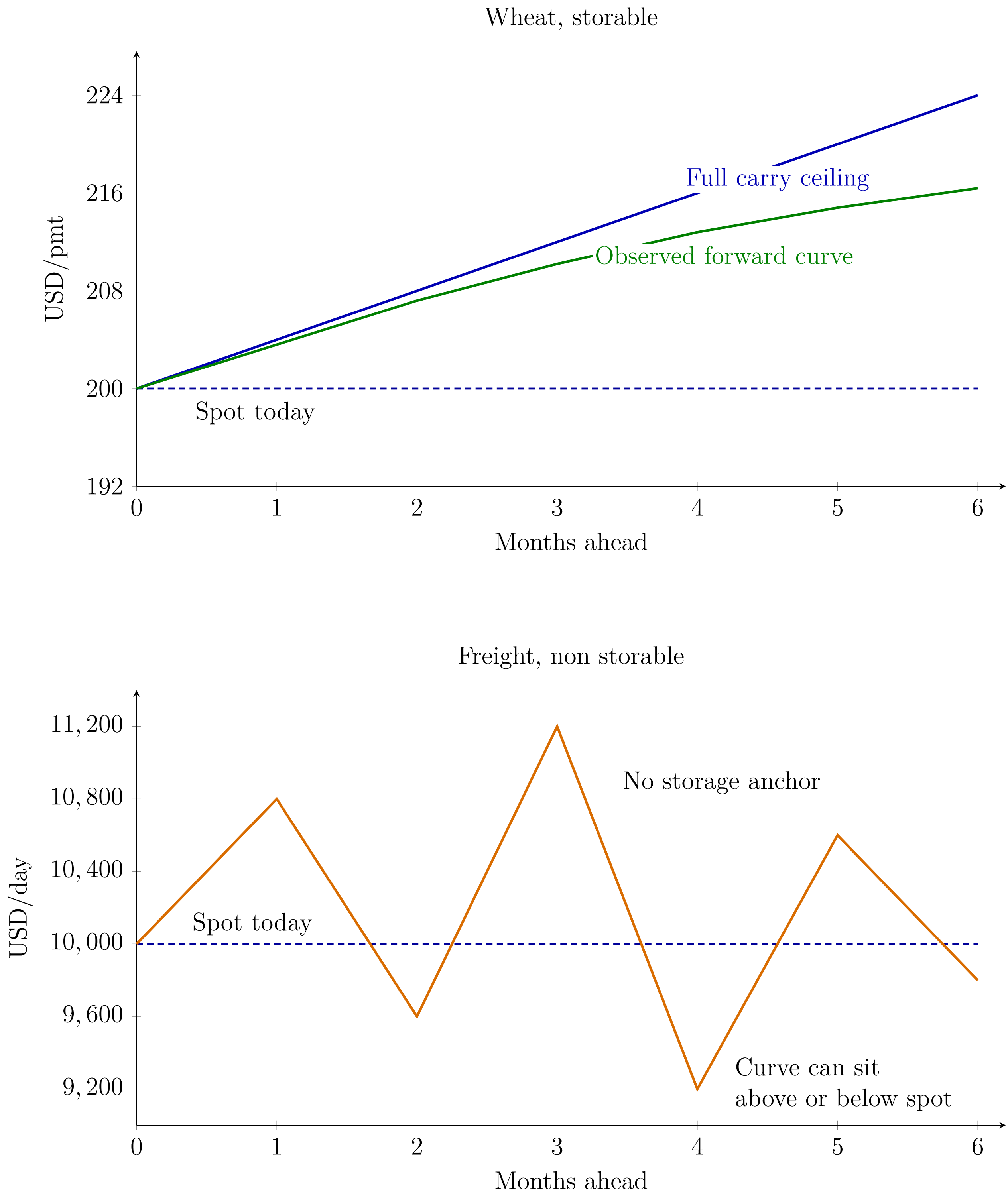



Figure 5.2: Storability links spot and forward prices for wheat through carry, while freight has no storage anchor. In the top panel, the dashed line is today's spot price, the blue line is the full carry ceiling and the green line is the observed forward curve. The top panel is in USD/pmt and the bottom panel is in USD/day.

In Figure 5.2 one can see why storability matters for time transformation. The top panel shows wheat, a storable commodity. The dashed horizontal line is today's spot price. The blue upward sloping line is the full carry ceiling over time, which represents the spot price plus storage, finance, insurance and other carrying costs. The green line is the observed forward price.

If the observed forward curve is above today's spot price, the market is in contango. Storing wheat may be profitable if the deferred premium is high enough to cover the trader's actual carrying costs. If the observed curve is below today's spot price, the market is in backwardation and storage is less attractive. Inventory holders are encouraged to sell promptly, while buyers may lock in lower deferred prices through forward or futures contracts. Neither curve should be interpreted as a prediction that the future spot price will necessarily equal the current forward price.

The bottom panel of Figure 5.2 shows freight as the contrast case. Unlike grain and oil products, which can generally be stored, freight and electricity cannot be stored economically for later sale. For that reason, the orange forward curve fluctuates above and below spot prices. The figure shows why wheat and freight require different forward pricing logic: wheat is anchored by carrying costs, while freight cannot be stored. Withholding freight capacity requires a vessel to remain unemployed for a period, which is normally uneconomic. In periods of very low rates, however, owners may lay up vessels when they judge this to be the best available economic option. Taking vessels out of service reduces active supply and may contribute to a later recovery in rates.

### In Form

Form transformation refers to the processing of raw commodities into products with enhanced utility and value. It represents the vertical dimension of commodity trading, where value is created not by movement or storage, but by conversion. It changes what the cargo effectively is and increases its market value, by altering the physical or chemical state of commodities to meet market demands, comply with industry standards and cater to consumer preferences.

Take wheat as an example. Raw wheat grains have limited direct consumption but serve as the foundational input for many other products. Milling wheat transforms it into flour, the primary ingredient for bread, pasta, pastries and other staples. This transformation not only changes the grain's form but also increases its market value by making it suitable for a variety of food products. Wheat can also be processed into starch, gluten and even biofuels. Each of these derivatives requires specific processing methods and caters to different market segments. Each derivative product competes for the same supply, so traders and processors in general calculate processing margins across alternative uses and whatever returns the highest PnL, and is therefore able to pay the highest price, takes the supply.

Trading firms play a pivotal role in facilitating form transformations. They coordinate sourcing, processing capacity and logistics, ensuring that raw materials are allocated to the highest-value sector and usage. For trading decisions, the trader compares the price of the processed forms with the cost of input raw commodity, processing expenses and risk adjustment.

Given a fixed amount of input commodities, traders and processors may use linear optimisation models to maximise profits. For example, a milling company might use linear programming to determine the optimal mix of wheat varieties to produce different types of bread, considering constraints like processing capacity, input costs and market prices. Competitive dynamics further influence these decisions, as firms must anticipate capacity expansions, technological upgrades and pricing strategies of rivals.

Freight pricing is another crucial element influenced by form transformation. Processed goods often have different transportation requirements, e.g. container transportation, which compared to the transport of raw commodities is in general more expensive than bulk transport. For example, flour may require more stringent handling and storage conditions than wheat grains to prevent spoilage and contamination. These factors affect freight costs, which must be incorporated into overall form-margin calculation.

### 5.2.1 Applied example: Fertilizer blending and freight in West Africa

Form transformation in fertiliser trade means blending standard nutrient products into a crop- and soil-specific grade. Nitrogen can be supplied through urea, phosphorus through diammonium phosphate (DAP) or monoammonium phosphate (MAP), and potash through muriate of potash (MOP). The commercial value comes from converting separate inputs into a fertiliser mix that better matches local demand.

Consider the phosphate producer OCP as a case study. It mines phosphate rock in Morocco, converts it into products such as phosphoric acid, and produces DAP, MAP and NPK fertilisers. In West Africa, OCP's model treats DAP not only as a finished product but also as a phosphorus base that can be combined with other nutrients closer to the buyer and sold at a premium (Fabbe et al., 2018).

Different crops require different recipes. Corn may require more nitrogen to support growth. Cocoa may require more potash, while cotton may require a different balance of nitrogen, phosphorus, potash and micronutrients. OCP has developed formulations for maize and cocoa in Nigeria, and for cotton in several West African markets. The trader is therefore converting their form so that the final product matches local soil and crop demand.

A simple example is 100 tonnes of 15:15:15 fertiliser. This means the finished blend must contain 15 percent of nitrogen, 15 percent of phosphate and 15 percent of potash. Therefore, the finished blend needs 15 tonnes of each.

DAP contains about 46 percent phosphate. To supply 15 tonnes of phosphate, the blender therefore needs about 33 tonnes of DAP. DAP also contains nitrogen. The 33 tonnes of DAP provide about 6 tonnes of nitrogen. The blend still needs another 9 tonnes of nitrogen. Urea contains about 46 percent nitrogen. To supply the remaining 9 tonnes of nitrogen, the blender needs about 20 tonnes of urea. MOP contains about 60 per cent potash. To supply 15 tonnes of potash, the blender needs 25 tonnes of MOP.

The remaining 22 tonnes consist of carrier material, such as limestone or gypsum. This brings the blend to 100 tonnes and helps achieve the required nutrient concentration and handling quality. This brings the recipe as follows:

$$
\begin{aligned}
&+ 33 \text{ tonnes of DAP} \\
&+ 20 \text{ tonnes of urea} \\
&+ 25 \text{ tonnes of MOP} \\
&+ 22 \text{ tonnes of carrier material} \\
&= 100 \text{ tonnes of 15:15:15.}
\end{aligned}
$$

The precise commercial recipe may differ slightly because nutrient assays, moisture, secondary nutrients, micronutrients and blending tolerances must also be considered.

The example also shows why form transformation cannot be separated from space and time. DAP may come from Morocco, while urea can be sourced from the Middle East, China, Russia or a local producer. The cheapest FOB urea is not necessarily the cheapest delivered input. A Chinese offer may be attractive on FOB, but the longer sailing time can increase freight exposure and create a risk of missing the planting window. A closer origin may cost more FOB but arrive earlier and reduce execution risk.

Freight therefore shapes the blending plan. A large programme may justify a full Handysize or Supramax of one grade, lowering freight cost per tonne. Smaller and more varied demand may justify mixed parcels. Once products are assembled at one load region or hub, a five hold geared vessel might carry DAP in holds one and two, MOP in hold three, and urea in holds four and five. At destination, each product is discharged separately, stored, tested, blended and bagged. Full ships provide scale. Mixed parcels cost more, but preserve flexibility to make the right blend for the right crop at the right time.

## 5.3 Transformation in Freight Trading

Freight trading is different from commodity trading in the details, but overall it operates within the same space-time-form dimension. Traders seek to maximise profits by strategically manoeuvring vessels and transforming transport capacity. Understanding these dimensions is crucial for navigating the complexities of maritime markets and capitalising on emerging opportunities, even if freight rates are shown to be globally mean reverting over the long-term (Adland and Cullinane, 2006).

Figure 5.3 places the space-time-form framework inside a commodity freight value chain, from FOB origin to CFR destination. The figure shows that freight is the central space transformation. Transformations in time and form may occur before loading, during the export process, or at destination.

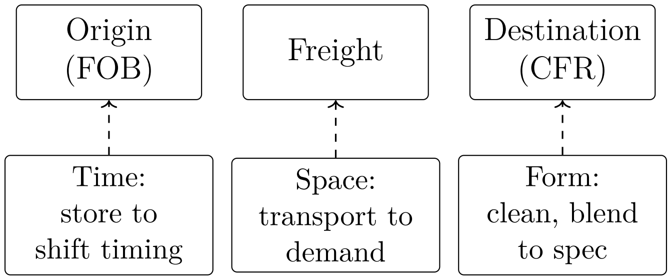



Figure 5.3: Simplified value chain for agricultural freight trading

### 5.3.1 In Space

Space is the primary arena for freight traders (Adland et al., 2017). Value is created by positioning vessels from low-earning regions to high-earning ones (Laulajainen, 2007). Traders constantly monitor global trade flows, economic indicators and geopolitical events to predict where demand for shipping capacity will increase (and where it will not!).

For instance, a surge in soybean exports from Brazil to China, such as during periods of trade tension between USA and China, increases demand for bulk carriers in the South Atlantic. Freight traders anticipating this shift may ballast bulk carriers towards South American loading regions before the export peak, in order to capitalise on the expected premiums during peak export seasons.

Advanced technologies, such as AIS data, enable traders to track vessel movements in real-time. This information allows them to make informed decisions about where to allocate their fleet. Combined with regional supply-demand balance sheets, this information allows traders to estimate whether a spatial premium justifies the repositioning investment.

However, space can also be a restriction on trade in the sense that a blockage can make it much more expensive to deliver goods. The Strait of Hormuz is a good example of such a choke point. A party blocking this strait can make it difficult, if not downright impossible in the quantities needed, to supply the world with e.g. fertiliser and oil in the volumes expected prior to a blockade. Traders solve these problems either by finding alternative sources of supply or finding out at what price point demand destruction occurs.

Figure 5.4 turns this spatial decision into a simple margin test. The trader starts with the FOB price at origin and adds ocean freight, insurance, finance and documentation to calculate the landed cost at destination. This landed cost is then compared with the expected CFR sale price from the destination buyer. The trade is normally attractive only when the expected CFR sale price leaves enough margin to compensate for execution risk and provide the required profit. However, the initial CFR sale may have a negative margin if the trader expects the value of the resulting optionality to exceed that loss.

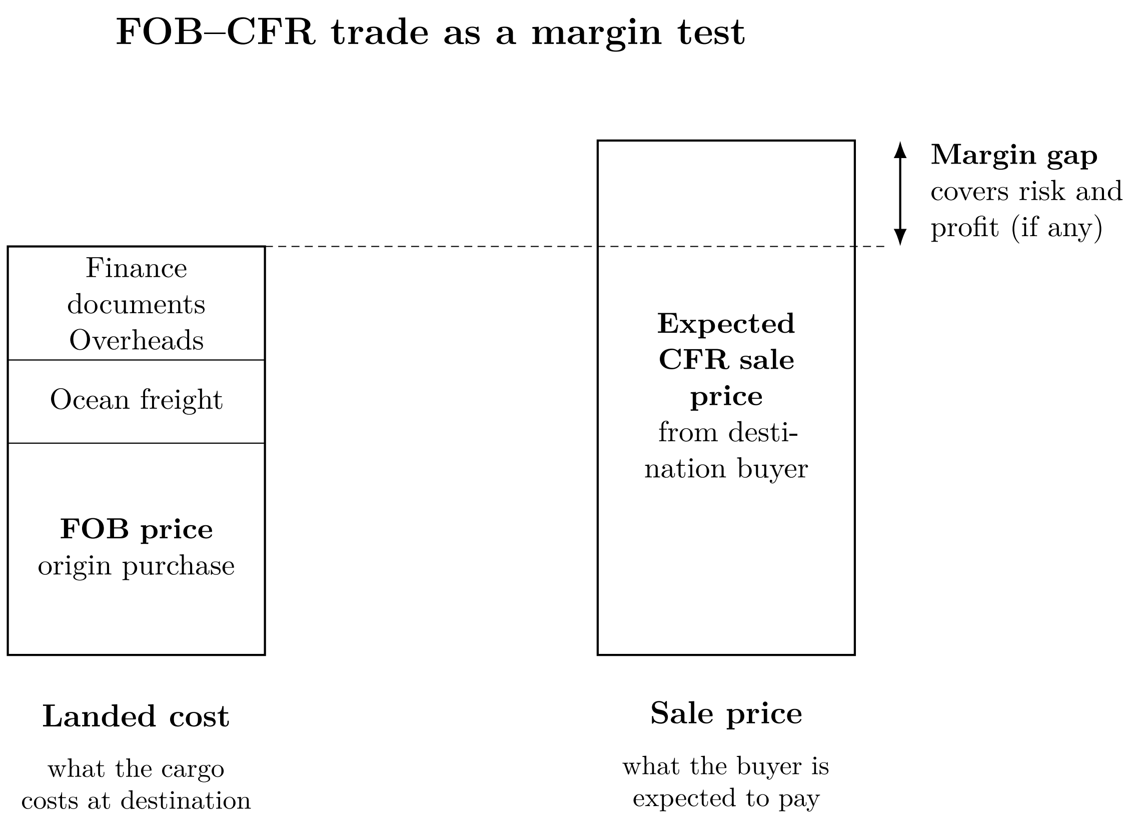



Figure 5.4: Theoretical spatial transformation from FOB purchase to CFR sale

### 5.3.2 In Time

Timing is another critical dimension in freight trading (Zannetos, 1966). Unlike commodity traders who store inventory to arbitrage time, freight traders cannot store transport capacity. Instead of storage, freight time arbitrage is achieved through scheduling and contract structuring. Traders aim to synchronise vessel availability with anticipated demand peaks in order to secure higher freight rates. This requires precise forecasting to ensure that vessels reach their destinations at the most advantageous times. For example, a freight trader anticipating a spike in fertiliser exports from the Arabian Gulf can schedule vessels to arrive shortly before the expected increase in cargo volume. Arriving too early may result in waiting time and opportunity cost; arriving too late means missing the premium.

However, timing strategies are inherently risky. Weather disruptions, port congestion and unexpected changes in market conditions can quickly erode expected gains (Adland, 2003). As freight capacity is perishable, timing deviations translate directly into lost earnings.

The timing dimension is influenced not only by macroeconomic conditions but also by contract characteristics at the micro level. Alizadeh and Talley (2011) demonstrate, using a large sample of individual dry bulk charter contracts from January 2003 to July 2009, that laycan duration affects dry bulk freight rates. A longer laycan may provide flexibility but typically has different pricing from a tight loading window, reflecting the value of timing.

Effective time transformation therefore combine elements of forecasting, assessment of contractual flexibility and risk management, all done under uncertainty. Unlike commodity storage decisions, which smooth supply over time, freight timing decisions attempt to match mobile capacity with temporary demand spikes.

### 5.3.3 In Form

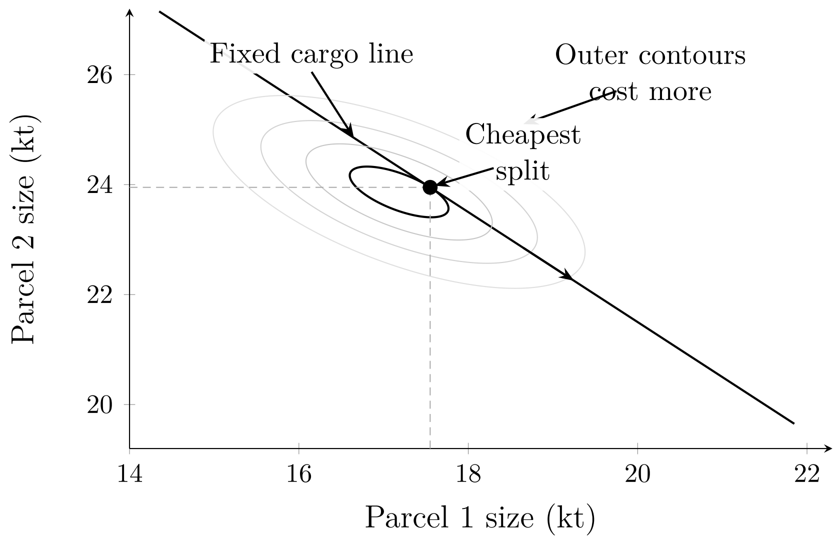
While space and time dominate short term vessel deployment, form determines which employment choices are available to the vessel. In freight trading, form has both a physical and a contractual dimension.

Physical form refers to the characteristics of the vessel. Size, gear, hatch strength, tank top strength, hold condition, draft, ice class, age, fuel efficiency and emissions status determine which cargoes the vessel can carry and which ports it can enter. A geared vessel can serve ports without shore cranes. A vessel with suitable hatch and deck strength may carry project cargo on one leg and grain on a later leg. These characteristics widen or narrow the vessel's available employment set.

Contractual form determines how the vessel can be employed and how costs, control and flexibility are allocated between the parties. A voyage charter, trip time charter or period charter may involve the same vessel, but each contract creates a different economic exposure. Under a voyage charter, the owner normally bears bunker, port and duration risk. Under a time charter, the charterer normally pays the voyage costs and directs the vessel within the agreed trading limits. Redelivery ranges, cargo exclusions, cancellation dates and notice periods also affect where and when the vessel becomes available for its next employment.

Most physical vessel characteristics are fixed over the spot trading horizon. An owner cannot change the vessel's size, gear or fuel consumption simply because another cargo pays more. Over a longer horizon, the owner may alter form through retrofits, technical upgrades or changes in fleet composition. The investment is justified only when the expected value of the additional employment choices exceeds the cost of creating them.

Form therefore matters because it determines which employment chains are feasible. A vessel may be positioned in the correct region at the correct time, but still be unable to perform the available cargo because its technical or contractual form is unsuitable.




**How to read it**

- The trader must ship 41,500 mt min/max.
- Each point on the diagonal line is a different split between Parcel 1 and Parcel 2.
- Each ellipse is a total logistics-cost contour.
- The optimum is the tangency point: Parcel 1 = 17.55 thousand tonnes; Parcel 2 = 23.95 thousand tonnes.
- At this point, shifting another tonne between parcels no longer reduces total cost.

Figure 5.5: Illustrative form transformation through multi cargo parcel-mix optimisation

Figure 5.5 shows form transformation as a practical optimisation problem when considering how to price a voyage. A commodity trader must ship a fixed programme of 41,500 tonnes and decide how much to allocate to Parcel 1 and Parcel 2. Every possible split lies on the diagonal line because the total must always remain 41,500 tonnes. Moving along this line changes the parcel mix while keeping the shipment programme unchanged. The ellipses show total logistics cost for each split. Each contour reflects the combined cost of freight, port handling and operational constraints. The lowest-cost feasible solution is where the fixed cargo line touches the lowest cost contour. In the figure, this occurs at about 17,550 tonnes in Parcel 1 and 23,950 tonnes in Parcel 2.

The trading implication is important. The trader is managing form because the parcel combination must meet the final specification. At the same time, the trader is also managing space and time because different parcels may use different ports, vessel arrangements, loading windows or handling patterns. Figure 5.5 therefore shows that a form decision often becomes a combined space-time-form optimisation. The example is theoretical, but it illustrates the tension between the commodity trader's preferred parcel structure and what a shipowner or freight trader can realistically offer. In the spot market, where a suitable vessel is already in position, the available options can be calculated directly. Forward pricing is more difficult because the freight seller will normally require either a premium or flexibility in parcel sizes to accept the freight price risk on behalf of the commodity trader.

## 5.4 Space, Time and Form: The Shipowner's Multi-Leg View

The freight buyer normally prices one cargo movement. The shipowner evaluates a sequence of vessel days. This difference shows space, time and form from the other side of the freight market. For commodity or freight trader, the key question is whether a route price helps the cargo move. For the shipowner, the key question is whether a fixture is the best use of the vessel across its next employment options. The shipowner is therefore not only pricing one voyage, but transforming vessel capacity across space, time and contract form.

A voyage freight rate may be quoted in USD per metric tonne, but the owner does not evaluate the cargo in that unit alone. The owner estimates the gross freight income, deducts voyage costs and converts the remaining income into a time charter equivalent in USD per day. This allows the current voyage to be compared with other employment choices available to the vessel such as a trip time charter, period charter or alternative voyage.

The USD per metric tonne rate still matters because it determines the voyage revenue. However, it is an input into the calculation rather than the final decision measure. The owner's main comparison is the expected daily earnings across the relevant employment horizon.

Every fixture changes three elements of the vessel's position.

- It consumes vessel days and determines when the vessel becomes available again.
- It moves the vessel to a new region and determines where the next employment begins.
- It preserves or removes future cargo choices according to the vessel's physical and contractual form.

This is the shipowner's version of transformation margin. The owner compares the value of fixing now with the value of waiting, ballasting, repositioning or accepting a different contract form. The decision is attractive only if the expected earnings after the fixture exceed the opportunity cost, voyage cost, waiting time and risk allowance.

A voyage paying USD 20,000 per day may therefore be less attractive than a voyage paying USD 10,000 per day. The higher paying voyage may last longer, end in a weak region or cause the vessel to miss a valuable loading window. The lower paying voyage may place the vessel close to a strong next cargo and improve earnings over the full sequence.

This forward looking element has long been recognised in shipping economics. Current employment decisions depend on expectations about future market conditions (Zannetos, 1966). Freight earnings are also stochastic and uncertain rather than known when the fixture is agreed (Adland, 2003). Regional earnings differences are connected through vessel repositioning, but this takes time because vessels must physically move between markets (Adland et al., 2017).

Owner expectations cannot normally be observed directly. A fixture record shows the agreed rate, route, vessel and contract terms, but it does not reveal the owner's full view of the next market. That view must therefore be inferred from quotations, fixture choices, ballast decisions and later vessel movements.

The following examples isolate the logic across several legs. Each trip is assumed to last 30 days. The FFA reference rises from USD 14,000 per day for Trip 1 to USD 15,000 for Trip 2 and USD 16,000 for Trip 3. This simplified forward curve is illustrative. In practice, the relevant FFA value may vary by month and vessel specification.

Time charter income means each voyage has already been converted into time charter equivalent earnings after voyage costs (Stopford, 2009). Profit versus FFA means the daily result relative to the FFA reference. It is not the owner's final accounting profit after operating, financing and capital costs.

| Trip | TC income USD/day | FFA reference USD/day | Profit versus FFA USD/day |
|---|---:|---:|---:|
| Trip 1 (30 days): A to B | 16,500 | 14,000 | 2,500 |
| Trip 2 (30 days): B to C | 14,250 | 15,000 | −750 |
| Trip 3 (30 days): C to D | 12,750 | 16,000 | −3,250 |
| **Average over 90 days** | **14,500** | **15,000** | **−500** |

Table 5.1: Scenario A: Strong first trip earnings, but weak continuation

| Trip | TC income USD/day | FFA reference USD/day | Profit versus FFA USD/day |
|---|---:|---:|---:|
| Trip 1 (30 days): A to Z | 12,500 | 14,000 | −1,500 |
| Trip 2 (30 days): Z to X | 16,250 | 15,000 | 1,250 |
| Trip 3 (30 days): X to Y | 17,750 | 16,000 | 1,750 |
| **Average over 90 days** | **15,500** | **15,000** | **500** |

Table 5.2: Scenario B: Weak first trip earnings and stronger continuation

Scenario A looks attractive on the first trip because the vessel earns above the FFA reference. However, its later trips are weaker, so average earnings over 90 days fall below the benchmark. Scenario B accepts lower earnings on the first trip but positions the vessel for stronger subsequent employment. The lower initial income is therefore a deliberate choice, not necessarily a pricing error. For the shipowner, the example shows that the trade is the complete employment chain rather than one fixture in isolation. The relevant comparison is expected earnings across all vessel days, including ballast, waiting and port time, measured against the corresponding market references. Commodity traders need to understand whether suitable vessels are open in the right region, at the right time and under acceptable contract terms. When this capacity is scarce, freight costs rise and CFR commodity margins tighten.

### 5.4.1 Why Owners Quote Different Voyage Rates

Building on the scenario from the previous subsection, suppose two owners quote the same voyage cargo at USD 22/mt and USD 26/mt. The USD 4/mt difference does not necessarily mean that the owner quoting USD 26 is unaware of the competing offer. Both owners may know the last fixture, the current broker indications and the approximate level at which competing tonnage is quoting. The difference may instead reflect how each owner values the vessel's space, time and form consequences of the voyage.

The owner quoting USD 26/mt may expect the voyage to create a poor continuation position. In space, the vessel may discharge in a weak region or require a long ballast to the next loading region. In time, the vessel may become open after an attractive cargo window has passed. In form, the cargo or contract terms may restrict the vessel's later employment choices. That owner therefore requires more income on the current voyage to compensate for the expected earnings given up afterwards.

The owner quoting USD 22/mt may hold a different forward view. The voyage may place the vessel close to a strong next cargo, satisfy a redelivery commitment or create access to a region where the owner expects rates to rise. That owner can accept less on the current voyage because the expected continuation earnings make the complete employment chain attractive.

The lowest executable freight offer is therefore not always produced by the owner with the lowest operating cost. It may be produced by the owner who assigns the highest value to the position created after discharge. In practical terms, the cheapest owner may have the cheapest combined valuation of the current voyage and the forward employment chain.

This distinction is important. A low quotation does not necessarily express a weak view of freight. It can express a strong view of where the vessel will be, when it will be open, and what choices remain available after discharge.

Continuation value is not the only reason why owners quote different rates. The difference may also reflect:

- Space: the vessel's current position and required ballast cost;
- Time: financing needs and willingness to accept near term cash flow;

- Form: cargo suitability and port restrictions and existing charter commitments and redelivery obligations;
- Cost: bunkers onboard, bunker consumption and technical efficiency;
- Execution: contract terms and perceived operational risk; and
- Risk: risk appetite and confidence in the forward view;

A freight quotation should therefore be understood as an owner-specific minimum acceptable price under a particular set of costs, constraints and expectations. It is not a statement of one universal value for the voyage.

If one employment chain were expected to produce persistently higher risk adjusted earnings than competing chains, vessels would gradually reposition towards it. The additional vessel supply would reduce the premium in the stronger region. Routes that lost tonnage would need to pay more to attract vessels back. This adjustment tends to equalise expected earnings across several legs, but it does not require every individual trip to pay the same daily rate.

The owner therefore requires more income on the current voyage to compensate for weaker expected earnings over the remaining time horizon. For example, if the voyage occupies the first 30 days of a 90 day planning horizon, the owner may seek a higher spot rate to offset the expected earnings shortfall during the following 60 days. This produces a higher quotation in USD/mt. Owners and charterers may broadly agree on the last concluded spot rate, but that rate does not determine the value of the next fixture to any owner. If the next owner calculates that the voyage would produce lower expected earnings than its competing employment options, it will quote the rate required to bring the complete employment chain closer to parity with those alternatives.

### 5.4.2 Implication for the Freight Buyer

For the freight buyer, different owner valuations produce a range of quotations, but these quotations are not equally relevant to the immediate purchasing decision. Where vessel quality, contract terms, counterparty risk and execution conditions are comparable, the lowest executable quotation represents the price the buyer can transact at. A higher quotation reveals another owner's minimum acceptable price, but it does not increase the price the buyer needs to pay. If the spread between cheapest and second cheapest is large, this information tells the freight buyer how deep the market is.

It is important that the buyer should understand what the cheapest offer represents. It is the price at which one particular owner is willing to exchange the vessel's present position for the position created after the voyage. A change in expectations about the next regional market can therefore change today's freight quotation even before the physical supply and demand balance on the current route has visibly changed. The freight matrix records the executable price available to the commodity trader. It does not show the full vessel employment chain behind that price. Understanding this distinction explains why informed owners can quote materially different rates for the same cargo.

This completes the shipowner view of transformation across space, time and form. The next section returns to the freight buyer and shows how executable freight values are combined with FOB prices to construct CFR matrices.

## 5.5 From FOB and freight matrices to CFR matrices

The transformations described above become more useful when they are turned into an operating tool. At the desk level, this tool is often a matrix. A FOB matrix shows the commodity value at each origin and shipment month. A freight matrix shows the cost of moving that commodity from each origin to a destination, also by shipment month. Adding the two matrices in the same unit produces the CFR matrix in Table 5.3.

Destination: Abidjan, Ivory Coast. Wheat values are illustrative. All prices are quoted in USD/mt.

**Panel A: FOB matrix**

| Origin | Jul 26 | Aug 26 | Sep 26 | Oct 26 |
|---|---|---|---|---|
| Constanta | 240.00 | 240.00 | 242.00 | 244.00 |
| Novorossiysk | **234.00** | **237.00** | **239.00** | **242.00** |
| New Orleans | 258.00 | 260.00 | 262.00 | 264.00 |
| Kwinana | 264.00 | 267.00 | 270.00 | 274.00 |

+

**Panel B: Freight matrix**

| Origin | Jul 26 | Aug 26 | Sep 26 | Oct 26 |
|---|---|---|---|---|
| Constanta | 30.00 | 31.00 | 32.00 | 34.00 |
| Novorossiysk | 35.00 | 37.00 | 39.00 | 39.00 |
| New Orleans | 25.00 | 26.00 | 27.00 | 28.00 |
| Kwinana | 60.00 | 58.00 | 56.00 | 55.00 |

=

**Panel C: Indicative CFR parity matrix**

| Origin | Jul 26 | Aug 26 | Sep 26 | Oct 26 |
|---|---|---|---|---|
| Constanta | 270.00 | **271.00** | **274.00** | **278.00** |
| Novorossiysk | **269.00** | 274.00 | 278.00 | 281.00 |
| New Orleans | 283.00 | 286.00 | 289.00 | 292.00 |
| Kwinana | 324.00 | 325.00 | 326.00 | 329.00 |

Table 5.3: FOB and freight matrices combine into a delivered CFR matrix. The space reading is the delivered origin ranking for each month. The time reading is the movement across each row. It is assumed that finance, documents, risk, and margin are roughly the same across origins and destinations.

The calculation is simple but commercially powerful. A FOB matrix tells the trader the nominal prices at origin and a freight matrix shows the price of freight. The CFR matrix combines the two and shows which origin is the cheapest into that CFR destination. This is where a theoretical supply chain becomes an operational trading decision.

The calculation is not matrix multiplication. It is cell-by-cell addition. Each FOB value must be matched with the correct commodity specification, destination, shipment month and unit. If the FOB value is quoted in USD/mt, then the freight value must also be converted into USD/mt. Only after the units are aligned can the trader compare origins on a delivered basis.

The space signal comes from reading down the matrix within each shipment month. For a given destination and month, the commodity trader can rank all possible origins by CFR. The cheapest FOB origin may not be the cheapest CFR origin. A Black Sea origin may look cheap on FOB, but if freight to the destination is expensive, its delivered value may be worse than a more expensive FOB origin with cheaper freight. Conversely, an origin with a higher FOB price can become the delivered winner if freight is cheap enough.

This is one of the cleanest ways to see how freight shapes global flows. Buyers do not consume FOB wheat. They consume delivered wheat. The destination buyer therefore compares the delivered replacement cost across origins. If one origin becomes cheaper on CFR, demand is pulled towards that origin. If the trade is large enough, that demand can strengthen the FOB prices at the winning origin, tighten vessel supply on the winning route, and force competing origins to lower their FOB basis if they want to compete for demand. Freight therefore does not sit outside the commodity price. It helps decide which surplus region can reach the deficit region competitively.

The time signal comes from reading across each origin row. The trader can compare July, August, September and later shipment months to see which part of the delivered CFR curve is creating or destroying value. If later FOB values are above nearby values, the FOB curve is in contango. If later FOB values are below nearby values, the FOB curve is in backwardation. The same language is often used for freight curves as a trading shorthand, although freight is not storable in the same way as wheat. In freight, the forward curve reflects expected vessel scarcity, route basis, bunker pressure, congestion and the opportunity cost of positioning ships.

The CFR curve combines the time structure of the commodity price and freight. A CFR contango may come from a rising FOB curve, a rising freight curve, or both. A CFR backwardation may come from a falling FOB curve, cheaper forward freight, or a fall in freight that more than offsets a rise in FOB price. This distinction matters because it tells the trader what is actually being traded. If CFR becomes more attractive in a later month because FOB is cheap, the commodity desk owns the view. If it becomes more attractive because freight is cheap, the freight desk owns much of the view. If both move together, the trade is a combined commodity and freight expression.

The CFR matrix is therefore a shared decision map between the commodity desk and the freight desk. The commodity desk uses it to compare origins and shipment months. The freight desk shows how route values, freight basis and the FFA reference affect the delivered price, and which origin is most likely to generate a freight sale.

For the matrix to work inside a commodity company, the freight values must represent the prices that the commodity desk and competing commodity traders would actually pay in the open market. If the internal freight desk skews those values because it prefers to retain a long freight exposure, the CFR matrix becomes distorted. The commodity trader can no longer value the position correctly and may choose the wrong origin or miss a sale. The internal freight trader may nevertheless be right that freight will be several USD/mt higher by the time of execution. In that case, the freight trader and commodity trader must capture the best combined value for the company by buying freight in the open market to facilitate the commodity trader's position.

For the commodity trader, this freight view appears in the CFR matrix as a delivered price. A few dollars per metric tonne in freight can decide whether an origin wins or loses. This is why the freight desk and the commodity desk should work from the same matrix. The commodity trader sees which origin clears the destination. The freight trader sees which route has value relative to paper and relative to competing physical routes. The result is a shared decision map.

The CFR matrix therefore connects the theory of price coordination with the daily work of trading. It answers two operational questions at the same time: where should the cargo move from, and when should the cargo move? The answer is not given by the FOB price alone, and it is not given by the freight price alone. It is given by the delivered price created when both are combined.

A commodity trader should still treat the CFR matrix as a decision aid rather than a contract. Quality, credit, documentary risk, export rules, port performance, vessel suitability and customer preference can all change the executable trade. But the matrix provides the first disciplined view. It converts scattered price signals into one comparable delivered value. That is why freight matrices matter for commodity traders. They show how freight rates and freight basis views become part of commodity allocation, and how prices distribute goods across space and time.

## 5.6 Time and Risk

Transformation margin is calculated before it is realised. The margin is only earned after the cargo, vessel or contract has moved through the execution process. During that period, each stage of the supply chain can change and may have a cascading effect on trade execution. The time lag is the source of execution risk. This is why the formula includes a risk allowance, which is the extra margin required to justify uncertainty.

Delay provides a simple example of how time affects margin in practice. Suppose a trader buys grain inland, charters a vessel and sells the cargo to an overseas buyer for a specific delivery time window. On paper, the transformation margin is positive. However, if the cargo arrives late at the export port, the vessel may wait and incur demurrage which could be for sellers account. The delay may also create extra storage and financing costs. If loading misses the agreed delivery time, the buyer may demand a discount or reject the cargo. The same delay can therefore affect several parts of the formula at once and deteriorate the margin.

Time is therefore a risk multiplier. A space transformation may fail because the freight rises before the vessel is fixed. A time transformation may fail because storage costs increase or quality deteriorates. A form transformation may fail because the adjusted cargo does not meet the specification. The longer the time horizon, the greater the exposure to unforeseen developments.

Property rights and contractual agreements help reduce uncertainty. They define who is entitled to the cargo and payment, who pays for the freight, who carries quality risk and what happens if a party fails to perform. However, contracts do not completely remove execution risk.

Finally, it is useful to distinguish between risk and uncertainty. Risk refers to outcomes that can be estimated with probabilities, such as the likelihood of a shipment delay due to adverse weather. Uncertainty, on the other hand, refers to unpredictable events like sudden policy changes or geopolitical conflicts, which cannot be easily quantified. Both matter for transformation margin, but they are managed differently: risk can often be modelled or hedged; uncertainty cannot be predicted and requires judgement, flexibility and a larger safety buffer.

## 5.7 Identifying Relationships that will Change

The above three levers of transformation explain how value can be created, but they do not by themselves tell the trader which lever to act on. Before cargoes are moved, stored or changed, the trader must first identify a relationship.

Table 5.4: Trading strategies and pricing relationships

| **Trading Strategy** | **Description** |
|---|---|
| Price vs. Balance Sheet | Flat price is not congruent with the balance sheet or historical price levels. Determine whether the flat price needs to move. |
| Instrument A vs. Instrument B | Buy or sell the cash commodity and buy or sell futures as a hedge, for example through basis trading. |
| Origin A vs. Origin B | The relative price between different origins. |
| Quality A vs. Quality B | The relative price between different qualities. |
| Time Period A vs. Time Period B | The relative price between different time periods. |
| Location A vs. Location B | The relative price between different locations. |

Table 5.4 shows how traders think in terms of price relationships. A flat price may look high or low, but it only becomes meaningful when compared with something else: the

balance sheet, another instrument, another origin, another quality, another time period or another location. Trading is therefore not only the activity of buying and selling things. In commodity and freight trading, trading is the identification of relationships that are likely to change, and the allocation of capital to profit from that change.

Each relationship in the first column points to a possible trading question. If flat price looks inconsistent with the balance sheet, the trader may ask whether the flat price is likely to adjust. If Origin A is cheaper relative to Origin B, the trader asks whether cargo can be move between the two markets.

The list is not exhaustive. Rather, it illustrates a method of thinking, i.e. how we can view the world of trading through the lens of relationships that change. Identifying the relationship is the first step. Table 5.4 identifies the relationship. The second step is to test whether it can be executed and converted into margin through space, time and form. This differs from Figure 5.1, which shows where value may arise from the three transformation levers.

As seen in Table 5.4, a margin test applies to all three arbitrage types. The trader buys the commodity in one state, pays the transformation cost, and sells it in a higher-value state. The trade is executed only when the remaining spread is positive after freight, carry, processing, finance and execution risk. Below are some test examples for each lever.

- **Spatial arbitrage.** A trader buys wheat FOB Origin A at USD 242/mt and sells it CFR Destination B at USD 264/mt. Ocean freight and finance total USD 20.7/mt. Net margin is:
$$264 - 242 - 20.7 = \text{USD } 1.3/\text{mt}.$$
The USD 1.3/mt is the trader's remaining margin before the risk allowance. The trade is attractive only if the trader can secure all costs at levels that leave an adequate expected margin after accounting for the full position. Any additional cost above USD 1.3/mt eliminates the margin on this trade unless it is offset by gains elsewhere. In practice, a trader may still accept a low-margin or loss-making trade if it creates valuable optionality, builds volume or provides access to subsequent arbitrage opportunities.

- **Temporal arbitrage.** A trader buys barley after harvest at USD 218/mt and sells three months forward at USD 227.4/mt. Storage, finance, insurance and shrinkage total USD 8.0/mt. Net margin is:
$$227.4 - 218 - 8.0 = \text{USD } 1.4/\text{mt}.$$
The trade is viable only if silo capacity, credit and quality preservation are available. Sometimes the scarce asset is not the barley itself, but storage and port capacity. In that case, booking capacity can become part of the trade.

- **Form arbitrage.** A trader buys one high-quality wheat parcel at USD 300/mt and one low-quality wheat parcel at USD 200/mt. A 50:50 blend gives an input cost of

USD 250/mt and can be sold as a medium-quality cargo at USD 255/mt. Blending, testing, handling and shrinkage cost USD 3.5/mt. Net margin is:

$$255 - 250 - 3.5 = \text{USD } 1.5/\text{mt}.$$

The USD 1.5/mt is the value created by converting two separate qualities into a cargo that better fits market demand. The trade only works if the blended cargo meets the contractual specification. In practice, form arbitrage often overlaps with space and time because cargoes may be bought from different origins, stored across different periods and blended at destination.

The examples show why physical arbitrage is usually a narrow margin business. A positive spread is only an initial indication of value. The trade remains attractive only if the margin is sufficient to absorb operational constraints, capacity bottlenecks, contractual obligations and execution risk. The trader must therefore test not only whether a price relationship appears favourable, but whether it can be converted into a reliable and executable profit.

## 5.8 The Power of Optionality

Optionality is a pivotal concept in trading. An option gives the holder the right, but not the obligation, to buy or sell an underlying asset, or to receive a cash settlement, under specified conditions. The buyer pays a premium for this flexibility and exercises the option only when doing so is beneficial. This flexibility may be undervalued in traditional discounted cash flow analysis.

Figure 5.6 shows how optionality changes the payoff while leaving spread uncertainty unchanged. A rigid contract forces the trader to execute in both states: if the spread widens, the trader captures the upside; if the spread collapses, the trader must absorb the loss. In contrast, an optional contract gives the trader the right, but not the obligation, to execute. The trader exercises when the spread widens and walks away when the spread collapses. The cost of this flexibility is the premium. Optionality therefore keeps the upside open while limiting the downside to the premium paid. When spreads become more volatile, this flexibility becomes more valuable because adverse moves are capped, while favourable moves can still be captured. In physical commodity trading, optionality manifests through various routes.

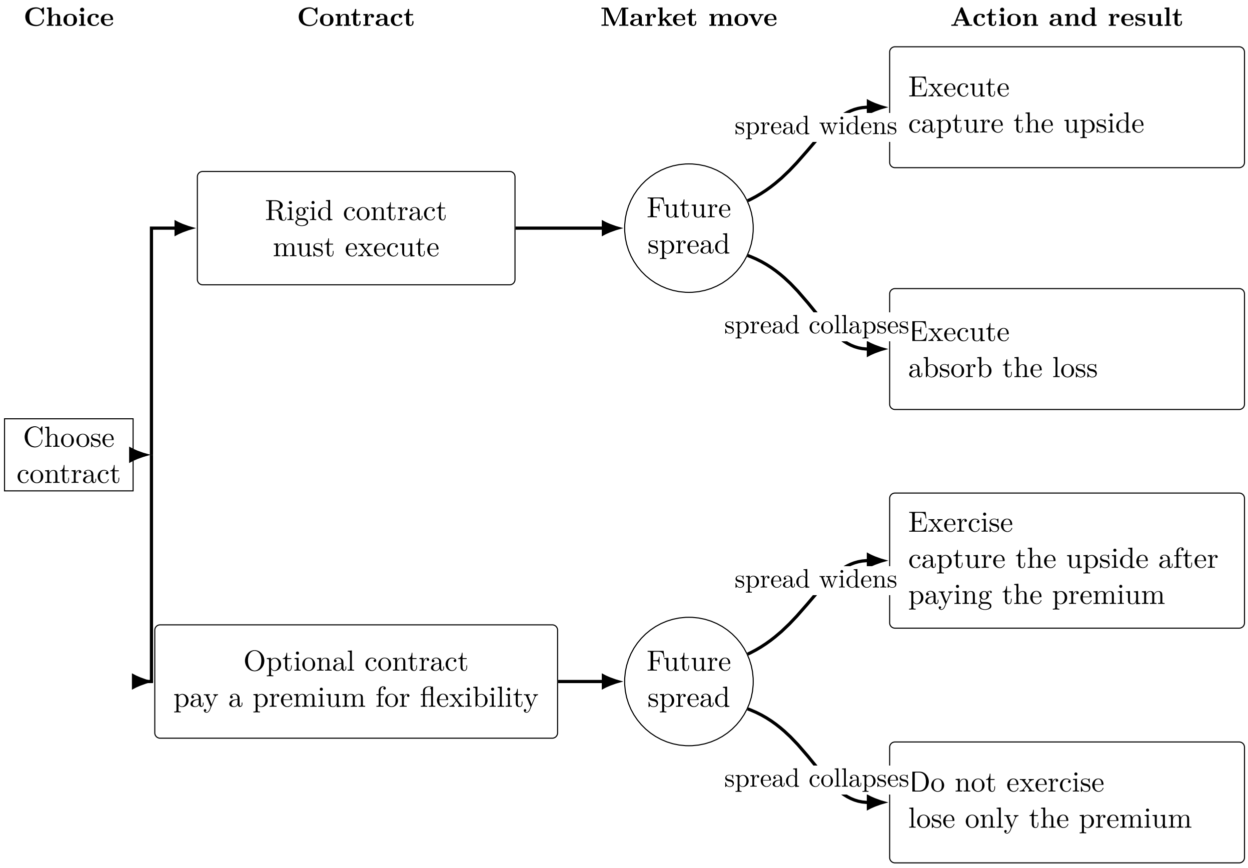



Figure 5.6: Optionality changes the commercial result while leaving spread uncertainty unchanged. Note that the action and result depend on whether the trader is long or short a call or put option.

1. Cash-and-Carry Trades: When futures markets are in contango, where future prices exceed spot prices, traders can buy the commodity at the lower spot price, store it and sell it at the higher future price, locking in a spread. Profitability depends on whether the spread exceeds storage and financing costs. The optionality comes from control over storage.

2. Pricing Period Optionality: Traders might negotiate contracts allowing them to choose the pricing month for shipments within a specified range (e.g., Month M or Month M+1). This flexibility lets them exploit calendar spread movements without immediate commitment. If the market shifts from contango to backwardation, where future prices are lower than spot prices, the trader can adjust their pricing periods to maximise gains. The value lies in the right to choose timing.

3. Exchange Arbitrage: Similar commodities traded on different exchanges may show temporary price discrepancies. A trader can buy the cheaper contract and sell the more expensive contract, but the apparent spread is executable arbitrage only if it exceeds all delivery, quality conversion, currency, financing and transaction costs. Otherwise, the position is a relative value trade with basis and convergence risk, not a locked arbitrage.

4. Physical Assets as Options: Owning assets like storage facilities or processing plants imbues traders with inherent optionality. For instance, owning storage allows traders to capitalise on high storage fees during oversupply periods. They can choose to use the storage themselves or rent it out at elevated prices. This strategy aligns with the real options theory in economics, where investing in physical assets provides flexibility to respond advantageously to market changes.

These examples show that optionality is not separate from transformation. It gives traders more choices over how to use space, time and form. The more flexible the trader is, the more routes are available for capturing transformation margin when market conditions change.

## 5.9 Trading Events and Margin Shocks

Most trading portfolios contain several sources of risk. Some of these risks can be reduced inside the book because exposures offset one another. However, not all risks can be diversified and internally neutralised. Some risks come from outside the portfolio and change the market itself. These discrete external shocks are called trading events and the exposure they create is event risk.

This often stems from geopolitical factors. Events such as trade embargoes, canal closures, war, political unrest, or changes in export policies can significantly impact supply and demand dynamics. Event risk matters for transformation margin, as it can change the formula suddenly. When new information emerges, the market rapidly seeks a new equilibrium. Prices adjust swiftly as traders reassess expectations, reallocating capital in response to updated information. This dynamic highlights the importance of being well-informed and prepared to interpret how events will affect prices.

Figure 5.7 shows the trading window created when relative prices move faster than physical capacity can respond. From left to right, beliefs are priced in, new information moves relative prices, physical reallocation lags, and spreads narrow as capacity catches up. The gap between the price move and the slower physical adjustment creates the trading window.

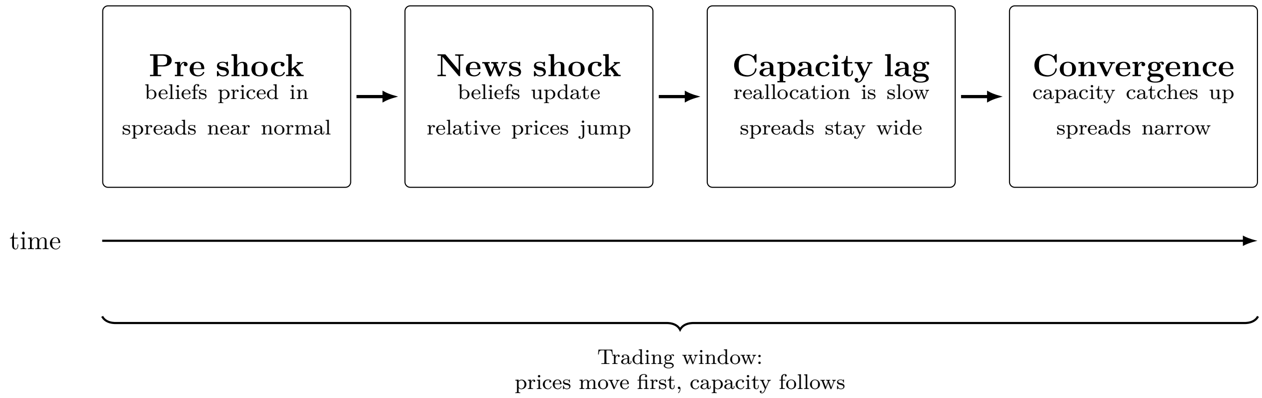



Figure 5.7: Relative prices move faster than capacity

A critical concept in trading event risk is understanding what is "priced in": the market's current expectations based on all available information. Prices reflect not just known facts but also collective anticipations of future events. For instance, if a drought in a major wheat-producing region is widely anticipated, its potential impact on supply may already be factored into current prices. By contrast, an increase in piracy in the Gulf of Aden, a War in Ukraine or Houthi's shooting rockets at commercial ships are not. There are theoretically three strategies for trading event risk (Donnelly, 2021):

1. Before it happens: Taking a view into the event: Traders may form a strategic position ahead of a known event, such as a government report on crop yields. By analysing economic indicators and employing mathematical models they estimate potential outcomes and position themselves accordingly. Risk monitoring is essential here as unforeseen results can lead to significant losses.

2. While it happens: Positioning your book for different outcomes: Traders might deem some of the risk of the event priced in. An example could be if there is a semi-hot war in Gaza, but traders might think that the price of buying, e.g. call options on oil, looks attractive as a small escalation of the war could involve Iran and Saudi Arabia putting a large part of the world's oil supply at risk.

3. After it happens: Re-evaluation of Prices: Sometimes the market may overreact to news, leading to price movements that are unsustainable in the short term. Traders can see this overreaction and take positions against the prevailing trend when it happens, expecting prices to revert as the market corrects itself.

In all strategies, risk management is central. Traders must consider factors like market liquidity, potential price gaps and the limitations of their predictive models. They often use hedging instruments and diversify their portfolios to mitigate adverse effects.

## 5.10 Trading or Merchandising?

Not all traders are alike; the swashbuckling days of Marc Rich traversing the globe for quick profits are over. Today's traders tend to specialise, investing heavily in knowledge, relationships and infrastructure within specific niches of commodity markets. This specialisation has led to siloed roles. In some large trading houses, while teams are called "traders," strategic decisions rest with the desk head; the rest execute strategies with limited autonomy (Nijs, 2014). Figure 5.8 distinguishes merchandising from trading: merchandising executes committed flows, while trading preserves and exercises flexible rights under constraints.

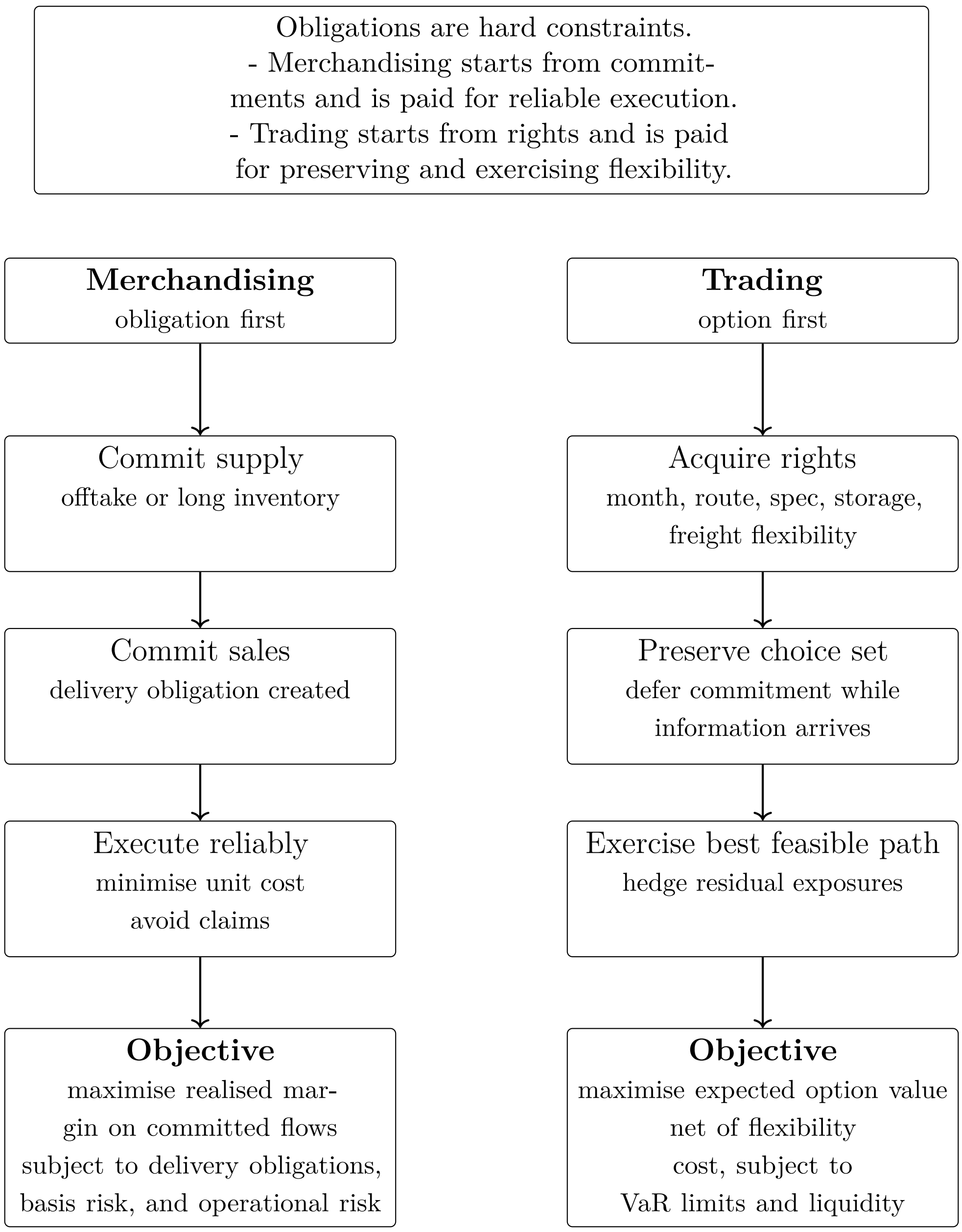



Figure 5.8: Merchandising creates value through reliable execution of committed flows. Trading creates value through preserving and exercising flexible rights under hard constraints.

Merchandising has become central not only to commodity flows, but increasingly to freight as well. Many trading firms secure long-term offtake agreements that guarantee a steady stream of product, offered at discounted prices because the trader provides prepayment or financing deals. This creates recurring physical purchase commitments for trading houses, although their net price exposure depends on their sales and hedges. The effect is reinforced when agricultural commodity trading companies own production assets. While this can be beneficial in rising markets, it poses challenges when markets soften.

In this setting, merchandisers must logically sell at the best possible price while minimising logistics costs and operational disruptions. Success hinges on reliability and strong consumer relationships, not just market intuition. Despite commodities being standardised, relationships matter. Many consumers run minimal inventories to reduce costs, so timely delivery and exact specifications are critical. Delays or off-spec materials can cause significant disruptions due to tight production tolerances and costly disposal of harmful by-products.

Thus, a merchandiser's core task is to ensure supply chain reliability which is typically achieved through the close coordination with the head trader. By consistently fulfilling customer needs without problems, a merchandiser can build a successful career in the commodity industry without having to be a speculative genius. A notion that might just lighten the mood for those interested in the commodity business but valuing stability over thrill.

Trading is fundamentally a team sport, where success depends on coordinated execution and effective communication. Regardless of individual roles, each team member's contribution is essential. Shared insights, joint risk management and collective decision-making ultimately determine trading outcomes, emphasising the importance of teamwork in navigating complex and dynamic market environments.

## 5.11 Key Takeaways

- Freight and commodity trading share much of the same underlying economic logic, even if their instruments differ.
- Traders create value by moving, timing and reshaping flows better than competitors.
- Optionality is valuable because it preserves future choices under uncertainty, but often comes at a price.
- The best trades often arise from recognising which relationships are about to change before they do - and before competitors realise they will change.

## 5.12 Connection to the Next Chapter

This chapter shows where trading edge can come from. The next chapter shows how such market views can be monetised through basis trading.

# Chapter 6

# Basis Trading

## 6.1 Fundamentals of Basis Trading

### 6.1.1 Basis = Cash Price − Futures Price

The previous chapter showed how balance sheets help traders identify local balance divergence from the market reference. This chapter explains how such divergence - known in trading terms as basis - can be managed and traded. Basis is the difference between the cash (spot) price of a commodity and its corresponding futures price (Nijs, 2014). Mathematically, it can be expressed as:

$$\text{Basis} = \text{Cash Price} - \text{Futures Price}$$

$$B = P_{\text{cash}} - P_{\text{futures}}$$

The equation is simple yet powerful. By engaging in basis trading, traders change the question from "will the commodity price go up or down?" to "will my local physical price strengthen or weaken relative to the benchmark?" This shifts the focus from the cash price to the relative value.

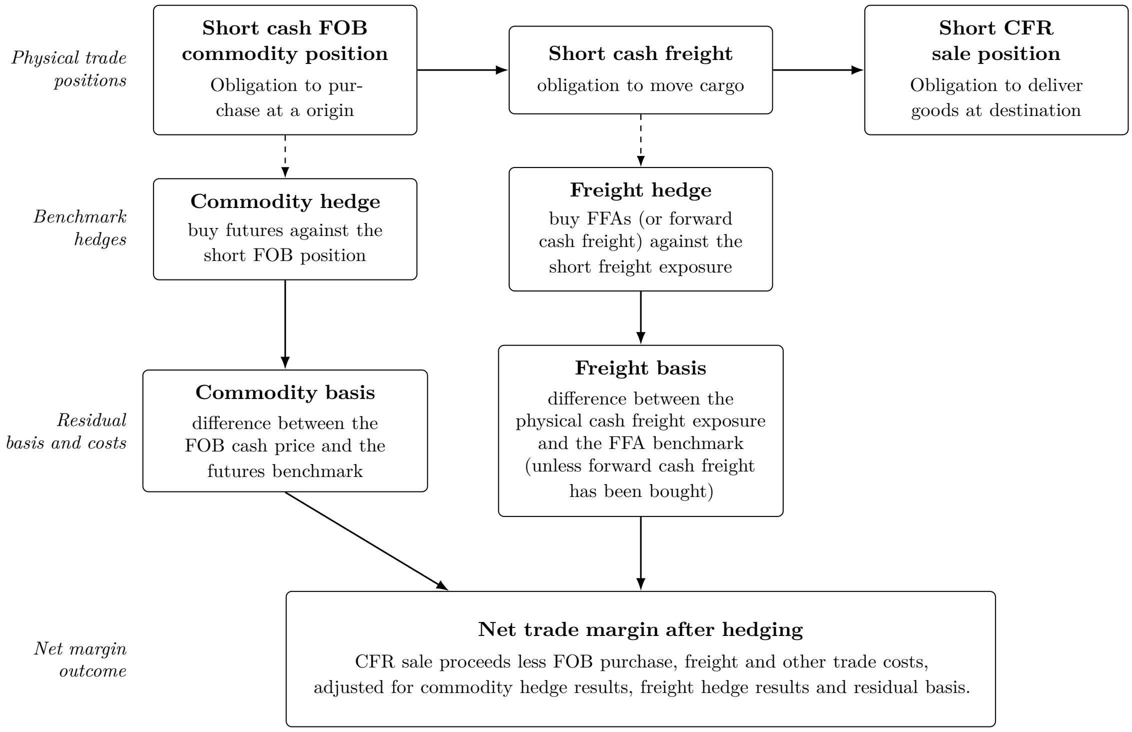



Figure 6.1: Formation of the net trade margin after hedging for a theoretical CFR sale done

Consider a trader who buys physical wheat in Poland at USD 300/metric tonne (mt) and simultaneously sells MATIF (Marché à Terme International de France) futures at USD 300/mt. The starting basis is zero. Later, the cash price increases to USD 320 per mt while the futures price rises to USD 318/mt. The basis has strengthened from zero to USD 2/mt. A trader who is long on the basis (meaning long physical wheat and short futures) profits from this strengthening because the cash position has improved more than the futures hedge has lost. The key here is not that the wheat cash price increased, but that the cash price improved *relative* to the futures reference.

The preceding wheat example describes a long basis position, where the trader owns physical wheat and sells futures. Figure 6.1 considers the opposite commercial sequence. Here, the trader has fixed a CFR sale before securing the FOB purchase and freight. The trader is therefore exposed to increases in both the FOB cash price and the freight cost. To reduce benchmark price risk, the trader buys commodity futures and FFAs. These hedges reduce benchmark exposure but leave commodity basis, freight basis and other trade costs. The final margin equals the CFR sale proceeds less the realised FOB purchase, physical freight and other trade costs, plus gains or losses on the commodity and freight hedges.

Basis trading is advantageous for several reasons. By hedging the general price level with futures, the trader is left mainly exposed to changes in the basis. This can make the position easier to analyse than a simple view on whether the commodity price will rise or fall. Instead of taking broad price risk, the trader focuses on the relationship between the cash price and the futures price. Futures markets also tend to be more liquid than physical markets, which makes it easier to enter, adjust or exit the hedge. Another advantage is that futures markets often react faster to new information, such as economic forecasts or weather disruptions, while physical cash markets usually adjust more slowly. This difference in the adjustment speed can temporarily widen or narrow the basis. For this reason, basis trading is not only a hedging tool; It can also create trading opportunities. However, basis trading does not eliminate risk. To understand this exposure, we need to examine what affects basis.

### 6.1.2 What affects basis?

Basis exists because a futures contract and a physical cargo are not the same thing. A futures contract is a standardised benchmark, referring to a defined commodity, delivery period, quality and price. A physical cargo, however, is specific. It has a particular location, shipment period, quality, storage position, freight requirement and counter-party terms. Basis is therefore the spread between cash and futures prices. It is the adjustment that connects the standardised futures market to the specific physical market. The basis is driven by four main factors: time, space, form and risk premiums.

***Time: carry and convenience yield*** Time captures the economics of holding the commodity. If a trader owns grain today but sells it at a later date, the commodity must be financed and stored. This creates a cost of carry, including financing, storage, insurance and handling losses. These carry costs affect the basis because the holder of the grain must be compensated for keeping the physical commodity rather than selling it immediately.

Storage costs can vary between regions because infrastructure and financing conditions differ. For example, grain held in inland silos in Western Europe may be cheaper to store and finance, compared to grain already positioned at an export port facility. These carrying costs affect the basis because holding physical grain is not free. If traders expect higher futures prices, they may choose to store grain rather than sell it immediately. However, the expected price improvement must be large enough to cover storage and financing costs. If it is not, the local cash price may weaken relative to the futures contract. In this way, the basis reflects the cost of keeping grain in place until it can be sold or exported.

Time is not only about costs, but also convenience yield: the value of having immediate access to the physical supply when availability is tight, logistics are uncertain or replacement is difficult. Convenience yield affects basis because buyers may pay more for nearby physical grain when they need physical supply now. In this case, the cash market reflected the immediate scarcity more strongly than the futures market.

***Space: geography and freight*** The space component reflects the economics of moving the commodity from where it is produced to where it is needed. Many bulk commodities tend to be seasonal and geographically unevenly distributed. This affects basis because a local cash price must include the cost of transporting from a surplus location to a deficit location.

In Europe, major grain production areas such as France, Poland and Germany often supply countries with less domestic production. For example, wheat produced in France may move by truck, rail or barge to export ports such as Rouen or La Pallice, and from there be shipped to other parts of Europe, Africa or Asia. These transport costs affect basis because grain at the farm is not worth the same as grain delivered to a port or consumption market.

Surplus regions typically have a weaker or negative basis relative to the futures benchmark, because the local cash price must discount enough to attract export demand. The Black Sea region, including Ukraine and Russia, is a clear example, where the local farm prices is significantly less than e.g. the MATIF futures price during harvest period because local capacity of transport to ports is a large port of the FOB price. Conversely, grain-deficit regions may experience a positive basis. For example, if China experiences a poor corn harvest due to adverse weather conditions, local demand for imported corn may increase. Importers may then be willing to pay a premium over international futures prices to secure the necessary supply at Chinese ports. This affects the basis because the local cash must rise enough to attract grain from alternative origins.

Additional logistics costs such as port handling fees, loading charges and insurance also influence the basis. For example, exporting grain from landlocked countries, e.g. like Hungary or Czech Republic, involves additional rail or barge transport to reach seaports, increasing the basis relative to e.g. MATIF futures. In importing countries, internal logistics costs, including trucking grain from ports to inland consumption areas, can significantly affect the local basis making the spot price higher than international futures prices. These frictions explain why basis is rarely "one number", because it is quoted by location, quality, timing and counterpart terms. Who the counter party is cannot be hedged away, thus the risk profile of a trade also heavily depends on whether a trader sold to a government entity or a private contractor as their terms and ability to enforce them vary significantly.

***Form: quality and commercial terms*** The form component reflects the specific characteristics of the physical cargo and the commercial terms of the trade. Futures contracts are standardised, but physical grain is not. The physical cargo has characteristics that are more or less valuable. For example, grain that meets strict import requirements on e.g. protein content may command a stronger basis than grain that requires blending or special documentation.

Contract terms also affect basis because they determine which costs and obligations are included in the cash price. Under FOB terms, the buyer normally arranges and pays for ocean freight. Under CFR terms, the seller includes freight to the destination port. These terms affect basis because the quoted cash price must reflect what the seller is actually providing with a specific deliverable physical position.

***Risk premium: residual uncertainty*** So to recap: Basis trading typically reduces exposure to large outright price moves, however, it does not eliminate risk. Instead, it shifts the type of risk being taken. Once the futures component has been hedged, the trader is mainly exposed to the relationship between the physical cash market and the futures benchmark. This risk is known as "basis risk" and represents the potential for the cash-futures spread to change in an unfavourable way. Basis risk arises when the hedge does not match the physical exposure closely enough, or when the cash price and futures prices move differently after the hedge has been placed.

The main types of risk in basis trading are:

- Price Basis Risk: cash and futures prices do not move in parallel.
- Location Basis Risk: the physical commodity is located somewhere different from the futures contract's delivery point.
- Calendar Basis Risk: the spot market selling date does not align with the futures contract expiry.
- Product Quality Basis Risk: the commodity's quality differs from the futures contract specifications.
- Freight and Logistics Risk: the actual costs of moving the commodity differs from the expected freight and logistics costs.
- Operational Risk: the storage, loading, unloading or documentation issues create costs that were not fully reflected.
- Counter party Risk: the cash counter party matters. If the hedge moves against the trader and the physical counter party defaults, the trader may face hedge losses without the expected cash-market offset, amplifying basis risk.

While the USD/mt numbers might seem modest, trading large volumes amplifies the financial impact. Consider a trader who buys 50,000 mts of wheat FOB Constanţa at USD 245/mt for shipment to Durban on a Supramax. The trader expects to sell the cargo CFR Durban at USD 295/mt. The expected freight cost is USD 40/mt and other costs are USD 6/mt. The expected margin is therefore:

$$295 - 245 - 40 - 6 = 4 \text{ USD/mt}$$

So, the trader expects to make USD 4/mt. To reduce risk, the trader hedges two exposures: Firstly, the trader sells wheat futures at USD 248/mt to protect against a fall in wheat prices; Secondly, the trader buys Supramax FFA cover at USD 12,000/day, which the freight desk estimates equal to about USD 40/mt freight, to protect the freight exposure.

Later, the trader sells the cargo CFR at USD 300/mt. This looks better than expected because the wheat sale price is USD 5/mt higher than expected. However,the hedges and the physical costs have also changed, more specifically: The wheat futures have risen from USD 248/mt to USD 252/mt. Because the trader sold futures, this creates a futures loss of

$$248 - 252 = -4 \text{ USD/mt}$$

The actual freight cost has also risen to USD 60/mt rather than USD 40/mt, because the physical route performs worse than the benchmark. However, the FFA benchmark used for the hedge rises only to USD 50/mt. As a result, the FFA hedge gains USD 10/mt, but this only partially offsets the USD 20/mt increase in the trader's physical freight cost.

The final margin is:

$$300 - 245 - 60 - 6 - 4 + 10 = -5 \text{ USD/mt}$$

On 50,000 mt, the trade loses:

$$50{,}000 \times 5 = 250{,}000 \text{ USD}$$

This example shows why basis risk matters. At first glance, the trade looked profitable because the CFR sale price improved USD 5/mt. The trader also hedged the two obvious exposures: wheat price risk with futures and freight risk with FFA. However, the trade still lost money because the hedges did not perfectly match the physical exposure. The example contains freight and logistics basis risk, as well price basis risk.

This is why basis trading requires more than a view on general price direction. Options can limit flat-price risk, but they do not remove basis risk. Consider a trader who owns physical wheat but has not yet fixed the MATIF component of the sales price. Buying a MATIF put option sets a minimum value for that futures component if MATIF prices fall. However, the option does not protect the trader if the local cash price weakens relative to MATIF because of changes in location, timing, quality, freight, logistics or local demand. If the trader has already sold MATIF futures against the physical wheat, the flat-price exposure is largely hedged and buying a put would add a new options position rather than protect the basis. The remaining basis risk must therefore be managed separately through closer matching of the physical and futures positions, position limits and trade sizes that remain within the desk's loss tolerance, including value-at-risk and stress-test limits. These controls are discussed in more detail in Chapter 7

### 6.1.3 Cash trading

In basis trading, the cash trading represents the physical side of the position. It is the real exchange of physical commodities for cash payments (Nijs, 2014). A local cash price is the price of a specific commodity at a specific place in a specific trading time window and under specific contractual terms. For example, a buyer may pay a certain price per metric tonne for wheat delivered FOB Odessa, Ukraine, during a defined shipment window. The cash price embeds "micro-details" that do not appear directly in futures price, such insurance costs, storage availability, and quality terms. This is why cash prices can differ from futures prices, which are the foundation of basis.

Cash trading is used when buying most types of commodities, such as wheat, corn and soybeans, as well as minerals and energy related products such as oil or fuel. Companies enter into cash commodity contracts to secure a specific good of a certain quality for a commodity they plan to use, effectively hedging against not only price fluctuations but operational efficiency. Wheat with a "wrong" protein content or oil with a "wrong" density and sulphur content might lead to production facilities to stop working. Therefore, the cash market can trade at a premium in case of scarcity or discount versus futures for certain types of commodities.

In freight, the equivalent cash markets is the physical freight market. A ship is fixed for a specific route and laycan window at an agreed rate, e.g. USD 45/mt, paid to the shipowner under a charter party. Just like a grain cash price, a freight cash price is specific. This is why freight also has basis: the actual voyage may not match the benchmark used for hedging FFA. If the ship is too long, too wide or does not have the right storage capacity, the economics of the deal change slightly for both the party hedging their exposure.

Not all cash trading involves physical delivery. A trader may buy a physical commodity with the intention of reselling it before delivery. In this case, there will be no physical goods change hands but only the monetary difference between contract and market prices is exchanged. They aim to buy a cargo at a low price and sell it at a higher price without ever taking delivery, or that futures value change relatively more in price than the cash price creating a profitable margin. However, this still creates physical-market risk when executed. If the trader cannot find a buyer at market price levels, the trader could be forced to either discount the cargo or become a CFR seller himself, with all the risk that entails, e.g. freight risk. Larger integrated trading companies often have more optionality because they can store, blend, ship or redirect cargoes. Smaller speculative traders may have less flexibility and are therefore more exposed to execution and liquidity risk.

For basis trading, the key point is that the cash leg contains the real-world features that make basis exist in the first place. Location, timing, quality, freight, storage and contract terms all affect the cash price. The futures market can hedge the broad benchmark price, but it cannot fully remove the physical specifications embedded in the cash trading.

### 6.1.4 Futures trading

If the cash trading is the physical side of basis trading, the futures trading is the benchmark side. A futures contract provides a standardised and liquid benchmark price against which local cash prices can be compared. This standardisation makes basis trading possible because it allows many different participants to trade the same futures contracts, even though the underlying physical commodity exists across many local markets (Kingsman, 2000). Futures markets are useful in basis trading for three reasons (Nijs, 2014):

- Price Risk Management: they allow traders to hedge broad price risk and speculate on future price movements. This hedging ensures more predictable income and aids in financial planning, reducing flat-price exposure. The traders just have to focus more directly on whether the local cash price will strengthen or weaken relative to the futures benchmark.

- Price Discovery: Futures markets aggregate information from numerous participants, reflecting collective expectations about future supply and demand. Because futures markets are liquid and react quickly to new information, they often move before local cash markets fully adjust. The futures price and the cash price may react to the same information at different speeds, leaving to potential change of basis.

- Liquidity: Traders who speculate on price movements add liquidity to the market. While they assume risk, their activities facilitate smoother transactions for hedgers.

For agricultural commodities, the relevant futures benchmark depends on the region and commodity being traded. In North America, the Chicago Board of Trade (CBOT) contracts are widely used for corn, soybeans and wheat. In Europe, MATIF, now part of Euronext, is the French futures exchange specialising in agricultural commodities like wheat and rapeseed. For a European grain merchant, MATIF functions as the reference price, while local cash markets trade at premiums or discounts to this reference price, expressed locally as basis.

Future prices also influence physical decisions, such as when to sell, whether to store and where to supply. If futures prices for later months are higher than spot prices (a contango market), it may be profitable to store the commodity and sell it later. This can encourage traders to store grain if the price difference is large enough to cover financing and storage costs. Conversely, if futures prices are lower (a backwardated market), immediate sale might be preferable. These physical decisions affect local availability, export flows and freight demand for a commodity.

Freight then links futures markets to the physical basis. If futures prices indicate a forthcoming increase in corn exports, freight traders might anticipate higher demand for shipping services and secure price cover, either FFA or physical voyage charters, in advance. If freight increases in price, FOB cash export prices may weaken relative to futures as the net back economics for CFR buyers. The cash-futures relationship becomes mostly concrete near contract expiry, where contract specifications and delivery link futures prices back to the level of physical market.

### 6.1.5 Tender and Delivery

Tender and delivery are the mechanisms that connect a physically delivered futures contract to the physical cash market at expiry. In this context, tender is the seller's notice that they intend to deliver under the exchange rules, while delivery is the transfer of deliverable commodity, or title to it, to the buyer. In this way, the futures contract is not only a financial benchmark as it becomes a claim on physical supply near expiry.

This matters for basis trading because tender and delivery create the institutional link between the physical cash market and the futures market (Euronext, 2025). The delivery mechanism helps prevent the cash-futures spread, or basis, from moving too far from each other as traders will buy/sell into the market to profit when they foresee a convergence at the end.

The key concept is convergence. In a physically delivered futures contract, convergence means that as the contract approaches expiry, the futures price should move toward the value of the deliverable physical commodity under the contract terms. The futures price and the cash price may diverge during the life of the contract, but as expiry approaches, they should not deviate too far apart if delivery is possible. If futures become too expensive relative to deliverable commodity, a trader with access to eligible physical wheat may sell futures and tender the commodity into the contract. If futures become too cheap relative to a deliverable commodity, a buyer may find it attractive to buy futures and take delivery instead of paying a higher cash price. These commercial flows help pull the futures and deliverable cash markets back toward each other.

This is why futures can serve as a hedge benchmark in basis trading. The futures price does not need to equal every local cash price. Rather, it must remain economically consistent with the value of the commodity that can satisfy the contract's delivery terms. Tender and delivery therefore give basis practical boundaries and help traders judge when a local cash premium or discount has moved too far from the futures reference (Pirrong, 2011).

Using the example of MATIF wheat, the delivery market represents the futures market where contracts can be settled through physical delivery. Figure 6.2 shows that tender and delivery economics create floating upper and lower boundaries around the futures price, within which local basis can trade. The middle of the figure is the deliverable market, where basis tends towards zero at expiry. The barriers are floating as when the economics change (FOREX, energy costs, transportation cost, etc.) the room in which the barriers can change are different.

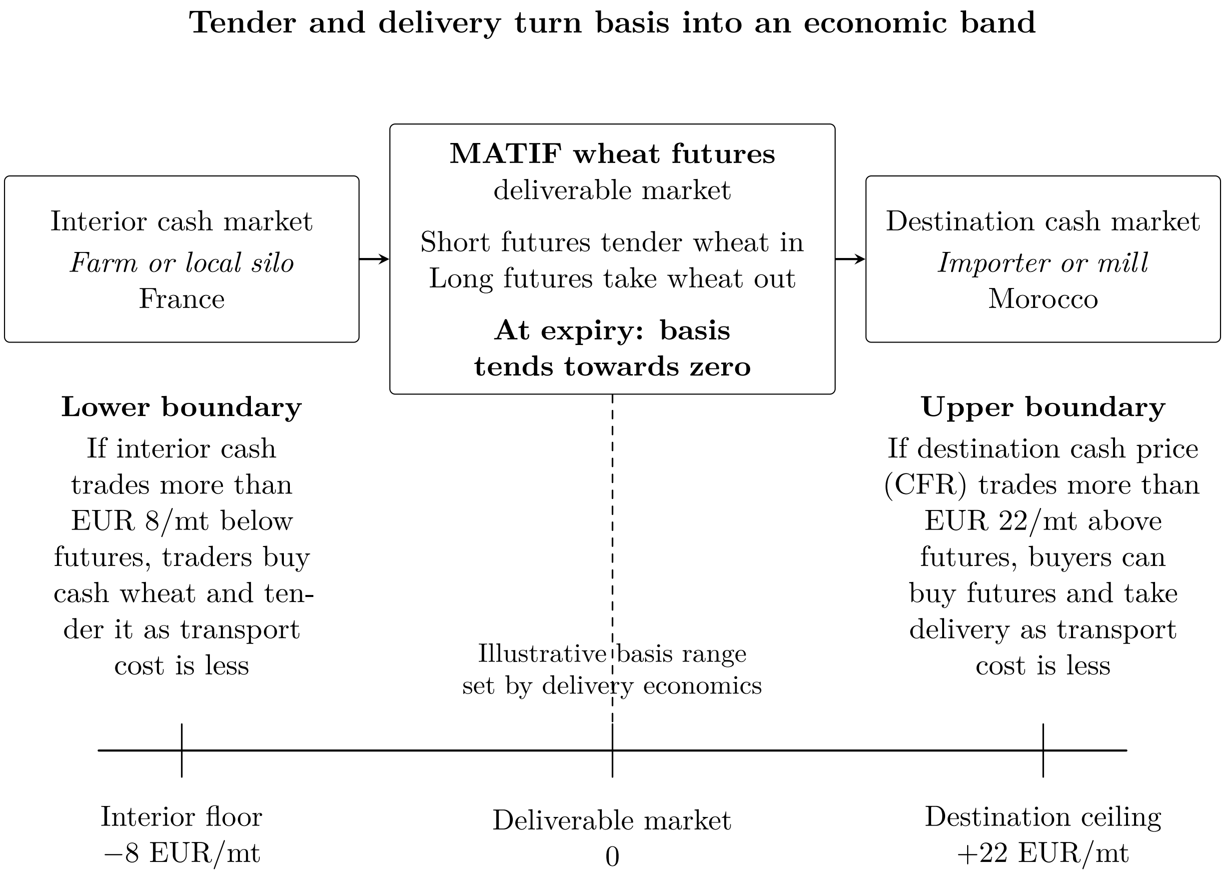



Figure 6.2: Tender and delivery impose economic boundaries on basis. At the futures delivery point, basis converges towards zero as expiry approaches. Away from the deliverable market, transport costs create a band around the futures benchmark: interior cash cannot remain far below futures once tendering becomes economical, and destination cash cannot remain far above futures once taking delivery becomes economical. Note certain assumptions on transport costs are necessary for decision makers

The interior market, such as local grain silos or farms, involves additional costs like transportation to the delivery location. These costs influence the basis, setting the economic lower boundary of the basis range. For instance, if transporting wheat from a farm in Northern France to the delivery point incurs a cost of EUR 8 per mt, the lowest the basis might go is EUR 8 per mt under the futures price as the trader can just buy from the farm and truck it to the delivery point. Any lower would create arbitrage opportunities, prompting traders to buy the cheaper physical wheat and deliver it against the futures contract for a profit, thereby correcting the price discrepancy. In other words tendering creates a "floor" on how cheap interior cash can become relative to the futures benchmark. Once the spread exceeds the cost to make delivery, delivery demand appears.

Conversely, the upper boundary of the basis range is established by the cost of sourcing wheat from the delivery market and transporting it to the destination market, such as a mill in Morocco. If it costs EUR 22 per mt to transport wheat from the approved FOB delivery silo to Morocco, the highest the basis might reach is EUR 22 per mt over the futures price. Beyond this, buyers would find it more economical to purchase futures contracts and take delivery themselves.

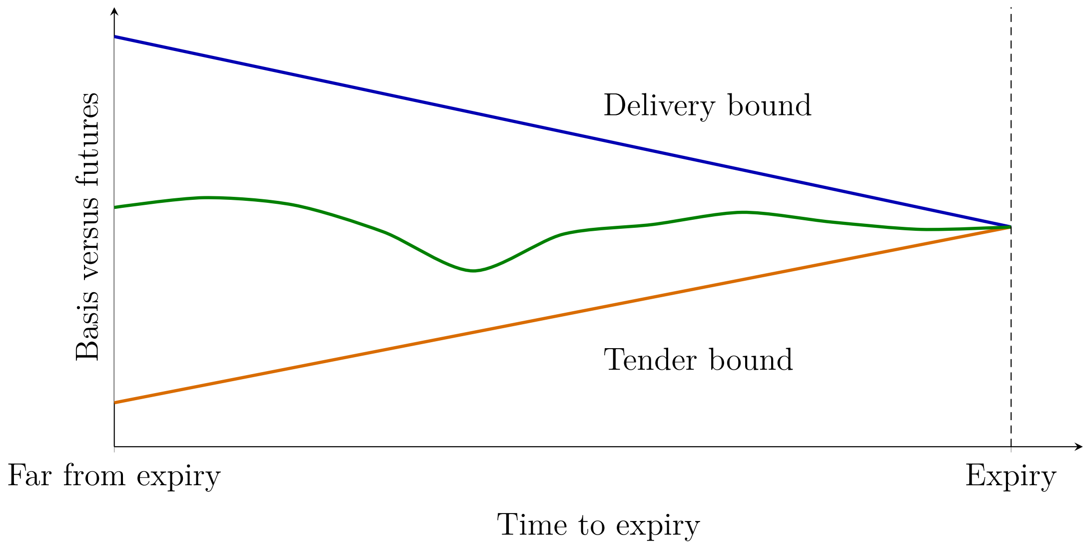



Figure 6.3: As expiry approaches, tender and delivery economics pull basis into a narrowing corridor around the deliverable market.

Tendering in this context refers to the action of delivering wheat to the futures market, sending the commodity to the delivery point specified by MATIF contracts. It signifies the lower end of the basis range, where selling to the futures market becomes a viable option for producers or traders. Delivery, on the other hand, involves taking possession of wheat from the delivery market, representing the upper end of the basis range.

Convergence ensures that at contract expiration the futures and cash prices align. It is worth noting that convergence is to the deliverable cash market, not to every local market. By knowing the costs associated with tendering and delivery, traders can establish value boundaries, manage risks and formulate effective trading strategies. They can decide on the timing, quantity and direction of their trades based on expectations of basis movements, ultimately enhancing their ability to capitalise on market opportunities in the dynamic agricultural commodity markets. These boundaries become practical decision rules discussed in the next section (Trading basis). Figure 6.3 extends this logic by showing how the basis corridor narrows as expiry approaches.

### 6.1.6 Basis as a Trading Signal

Understanding typical basis levels and patterns for commodities is essential for informed market decisions. Basis is not only a spread between cash and futures prices; it is also a signal about local market conditions. The trading analysis can guide various trading choices in several ways.

First, basis analysis is to evaluate whether a price should be accepted or rejected. Once the futures price is known, the basis shows whether the local cash price is cheap or expensive relative to the benchmark given average conditions. A strong basis suggest that buyers are competing for supply, while a weak basis may indicate abundant availability, limited storage capacity or high logistics costs - or a mixture of all three. In some cases, it may be better to hedge price risk and wait for a more favourable basis rather than accepting an unattractive offer.

Second, basis patterns can help traders compare buyers or sellers. Different bids and offers often imply distinct basis levels, even when they refer to the same commodity. To compare them properly, traders convert each bid or offer into a basis against the same futures. This makes it possible to compare transactions with different buyers, sellers, or locations.

Third, basis analysis helps determine when to buy, sell, store or move physical commodities. By comparing the current basis with historical patterns, traders can as part of their trading analysis review whether the cash market in a historical context is strong, weak or broadly in line with normal prices and conditions. When inventory is scarce and immediate availability is valuable, the nearby physical market can strengthen relative to futures, while abundant supply or high carry costs can weaken basis. This information helps traders decide whether the market is rewarding immediate movement or whether it may be worth holding inventory.

Additionally, monitoring the basis is valuable for risk management. If the basis strengthens or reaches a desired target, a trader may decide to close a position if the trader believes there is no more upside. Unusual basis patterns occasionally create profit opportunities. Merchandisers and traders who actively manage basis levels need to remain alert to these irregularities, which can open avenues to enhance margins or avoid losses. Maintaining competitive bids and offers is vital when seeking to capitalise on such trends, thus favouring benefits of scale and regular volume.

### 6.1.7 How Freight affects Commodity Basis

Freight is a universal feature of commodity markets because production and consumption rarely occur in the same place. Wheat, maize, soybeans, sugar and vegetable oils all have to move from surplus regions to deficit regions, the same goes for iron ore, oil or fertiliser. For that reason, the basis is not only a reflection of local supply and demand, futures price, quality and timing, but also by the cost and difficulty of moving it to where it is needed.

This is how freight affects the basis. Basis is usually introduced as the difference between a local cash price and a futures price. That definition is useful, but it can make basis sound like a purely financial relationship. In physical commodity trading, basis is also geographical. It reflects the cost of connecting the location defined by the futures market with the location where the commodity is actually consumed.

Sugar can be used to try and illustrate this point. The ICE Sugar No. 11 futures contract governs the physical delivery of raw cane sugar on a FOB basis to the receiver's vessel at a designated port in the country of origin (Intercontinental Exchange (ICE), 2023). The contract defines what can be delivered, including eligible origins, minimum quality, parcel size and delivery procedures. The special thing about sugar is that there are 29 designated deliverable origins, including major producers like Brazil, Australia, Thailand, India, and the United States. MATIF wheat by contract is only deliverable in France. Once sugar is delivered FOB, wherever that might be, the receiver must still move it to where it is needed.

An eligible delivery origin is therefore not automatically an equally valuable delivery origin. Sugar delivered in Brazil, Australia or Thailand may all satisfy the futures contract, but each origin creates a different delivered cost for the receiver when taking freight into account. Assuming freight from e.g. Thailand to Vietnam is cheaper than freight from Brazil, Thai sugar is therefore relatively more valuable due to its proximity to final use. Therefore freight, port access, vessel availability, congestion risk and more all affect what that sugar is worth in practice, as it determines the cost of bringing it from over supplied countries to under supplied ones. The freight clauses in Sugar No. 11 show how physical execution enters futures pricing. The contract sets rules for vessel nomination, minimum cargo size, load ports, draft, loading rates, laytime and demurrage. These details may appear operational, but they affect the economic value of delivery. A port that can only accommodate certain vessel sizes, loads slowly, or exposes the receiver to demurrage risk may be worth less than another eligible port. In physical commodity trading, any operational friction becomes economic friction.

The same logic applies to the short side of the futures contract. The seller wants to tender sugar from an origin where procurement, loading and delivery obligations can be met at the lowest cost. The buyer wants a delivery origin that can be moved onward efficiently. The futures contract defines the delivery mechanism, but freight determines the practical value of that delivery. This is why sugar basis trading is closely linked to origin, delivery options and geographical spreads, rather than only to the headline futures price.

A simple example can show this logic. Assume the Sugar No. 11 futures price is 20.00 cents per pound. This is roughly equivalent to about USD 441/mt. A buyer in North

Africa can receive deliverable sugar from either Brazil or Central America. Both origins satisfy the futures contract, but they do not have the same delivered value. If freight from Brazil to North Africa is USD 35/mt, the freight adjusted cash value is USD 476/mt. If freight from Central America to North Africa is USD 55/mt, the freight adjusted cash value is USD 496/mt. The futures price is identical in both cases, but the delivered economics are not. For this buyer, Brazilian delivery is worth USD 20/mt more because it can be converted into a lower delivered cost.

This is the practical meaning of freight inside the basis. The exchange contract standardises the sugar, the delivery rules and the reference price. Freight determines whether a delivery origin is useful to the receiver. In basis terms, freight is the bridge between the futures price and the cash value of the commodity at destination.

### 6.1.8 Basis Trading in Key Commodities

Basis trading is a fundamental strategy used in various commodity markets, including but not limited to grains, sugar, cotton, oil and freight. Although these markets differ in their physical characteristics and their usage, the underlying principles of basis trading remain consistent. At its core, basis trading separates flat price exposure from relative value. Traders analyse factors such as supply and demand dynamics, transportation costs, storage fees and quality differentials to determine the basis. They use this information to make informed decisions that align with their risk management objectives.

Figure 6.4 presents a general framework of basis trading for commodities. The trader starts with an FOB origin value and compares alternative routes to convert that value into an executable delivered price. One route moves the commodity through **space**, by using freight to convert FOB into prompt CFR. Another route moves the commodity through **time**, by storing or delaying the sale into a later CFR value. A third value moves the commodity through **form**, by blending, processing or re-specifying the cargo into an alternative CFR value. The figure shows that basis trading is more than simply a comparison between cash and futures. It is also the comparison of route-created values against the benchmark or hedge, followed by execution of the route with the best basis or between executable physical alternatives, and about choosing the route gives the best basis or netback.

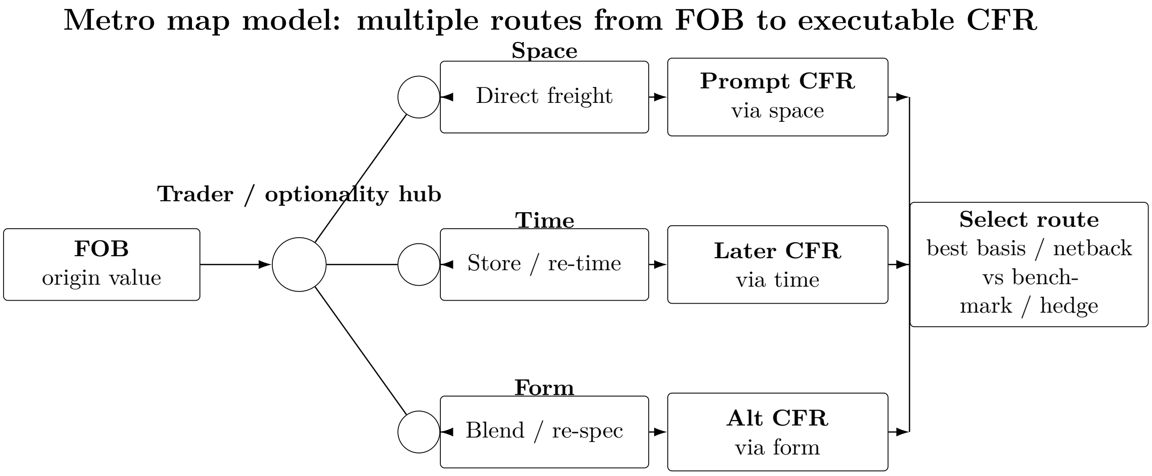



Figure 6.4: Optionality in FOB-to-CFR trading

However, the devil is in the detail and each market presents unique challenges and intricacies. Grain basis is often influenced by harvest cycles, storage capacity and inland logistics. Oil markets must account for refining capacity, infrastructure constraints, product specifications and geopolitical events. Freight adds another complication because shipping services are non-storable and freight rates can move quickly. Cotton traders must account for quality variation, international trade policy and demand from the textile and fashion industries. The basis exists in each market, but the strength of the cash-futures relationship determines how observable the basis is and how much basis risk remains.

**Grains** Grain markets provide the clearest starting point because wheat, maize and soybeans have well-established futures markets and relatively standardised contract specifications. Grain basis is influenced by local supply and demand, inland transportation costs, storage capacity, elevation margins, quality differentials and export competitiveness.

Using the Figure 6.4 framework, grain often moves through both space and time. The physical route reflects the cost of moving grain from farm or inland regions to domestic consumer, processor or export terminal. A strong export may pull grain toward ports and strengthen the basis. Weak export demand or high inland freight costs may leave grain trapped in surplus regions and weaken local basis.

The time route is also important because grain is seasonal and storable. During harvest, local supply increases sharply and storage capacity may become scarce, often weakening basis in producing regions. Later in the season, as stocks are drawn down and storage becomes more valuable, basis may strengthen. Grain merchants, farmers and exporters therefore use basis as both a pricing tool and a logistics signal. It tells them not only what the futures market is worth, but where grain is needed and when it should move.

Grain's basis is relatively observable because futures markets are liquid, harvest cycles are regular and transportation networks are well developed. This makes grain a useful benchmark for understanding basis trading before moving into more complex commodity markets.

**Sugar** The basis in sugar is more volatile and as shown previously, influenced by a wider array of factors compared to grains. Sugar trading requires a deeper analysis of origin-specific factors, delivery mechanisms and global trade dynamics.

- Quality and Origin: Sugar quality can differ by origin, colour, polarisation (sucrose content) and other attributes. These differences create physical premiums or discounts that must be reflected in the basis, which are closely tied to the specific origin and quality of the sugar.

- Delivery optionality: In sugar futures markets like the Intercontinental Exchange (ICE), the deliverer has the option to declare the origin and loading port after the contract expiration. It means the futures price often reflects the cheapest deliverable sugar and the basis can fluctuate based on the deliverer's choices. In grain markets, delivery locations and qualities are predetermined, leading to a more consistent basis.

- Geographical Spreads: Sugar basis trading often involves trading geographical spreads due to differing freight costs and regional supply-demand imbalances. A cargo from Brazil, Central America or Asia may satisfy the futures contract, but each origin has a different delivered value thus basis. Sugar exports are more concentrated in certain origins and trade corridors, so geographical spreads can become a driver of basis.

**Oil**

Oil is the clearest example where time, space and form dimensions are actively traded. Oil basis is not built around one price, but around benchmarks, location differentials, calendar spreads and product spreads (Long, 1995). Oil also differs from many physical commodity markets, because its basis risks can often be isolated and traded directly through liquid instruments.

Space basis arises from price differences between the same commodity at different geographic locations. For instance, the price of West Texas Intermediate (WTI) crude oil at Cushing, Oklahoma, may differ from Light Louisiana Sweet (LLS) crude oil on the U.S. Gulf Coast. An oil producer on the Gulf Coast selling LLS crude might hedge the price risk using WTI futures. However, since WTI and LLS trade at different prices the producer is exposed to locational basis risk, the risk that the price difference between LLS and WTI will change unfavourably. To mitigate this the producer can use a basis swap that specifically hedges the price differential between the two locations, thus managing the space basis risk.

Time basis, or calendar basis, refers to the price differences between oil contracts with different delivery dates. In oil futures markets this is observed in the term structure of prices, where the market can be in contango which means that future prices are higher than spot prices, or backwardation where future prices are lower than spot prices. For example, a refiner expecting to purchase crude oil in three months might face uncertainty about future prices. To hedge this risk they can engage in a calendar spread by buying futures contracts for the desired delivery month and simultaneously selling contracts for a different month. This strategy locks in the price differential between the two periods, allowing the refiner to manage exposure to price fluctuations over time.

Form basis refers to price discrepancies due to differences in the quality or specifications of oil products. Crude oil varies in terms of density, sulphur content, API gravity and other characteristics that affect its value and refining costs. Similarly, refined products like gasoline, diesel and jet fuel have different market dynamics and pricing. For example, an airline hedging jet fuel costs might use heating oil futures due to the lack of liquid jet fuel derivatives, but this substitution introduces product basis risk because, although both products are middle distillates and their prices are correlated, heating oil prices may not track jet fuel prices exactly. Traders manage this form basis risk by using swaps or options that more closely match the specific product, or by accepting some basis risk in exchange for greater liquidity in the hedging instrument.

Oil basis trading therefore requires attention to benchmark selection, infrastructure constraints, storage economics and product specification. It shows the full basis framework in a highly developed form arguably far ahead of most other commodity markets.

**Cotton** Let us look at a commodity that is slightly different. Basis trading is still applicable and widely used, but the product itself is different from oil. In cotton markets, the quality of the commodity, i.e. the fibre characteristics matter directly for value. Staple length, strength, micronaire, colour and contamination all affect spinning performance and fabric quality. Cotton is therefore priced first as a technical input cost to a production. However, recently clothing sellers have seen cotton as a differentiator in their marketing. Once it enters apparel, origin, production method and certification can become commercially valuable. Organic, regenerative or traceable cotton may command a premium even when its functional quality is close to conventional cotton. Organic cotton from a farm where the label is worth more than the lint may command a premium over conventional cotton, even when its functional quality is similar, because it gives the brand a story to sell.

This makes cotton different from bulk commodities such as oil or corn. In those markets, quality mainly reflects industrial use. In cotton, value combines physical utility with identity, documentation and trust. For traders, preserving that identity through segregation, certification and traceability becomes part of protecting the premium.

Firstly, quality variability is more pronounced in cotton than in grains. Cotton is graded based on factors such as fibre length, strength, colour and cleanliness, leading to a wide range of quality grades. These quality differences directly impact the basis because higher-quality cotton commands a premium, while lower-quality cotton trades at a discount. They also affect whether cotton is deliverable against the futures contract or acceptable to a textile mill. A bale may exist in the market, but if its grade does not match the delivery requirements, its value can diverge sharply from the futures benchmark. This gives cotton basis risk a larger quality-and-deliverability component than many grain markets.

Secondly, cotton is less perishable and can be stored for longer periods without significant degradation. As a result, cotton basis is not usually dominated by harvest pressure in the same way as grain basis. Carrying costs matter, but quality preservation and the timing of mill demand are often more important.

Additionally, cotton demand is closely tied to the textile industry and global fashion trends, which can be cyclical and influenced by economic conditions. A change in mill margins, consumer demand or textile trade flows can alter the value of specific grades, even if the futures market moves only modestly.

**Biomass**

In biomass markets such as wood pellets and wood chips, basis trading is structurally harder than in grains, oil, metals or freight because the physical product lacks a liquid futures market. There is no deep screen price, no standard exchange contract and no reliable curve against which traders can continuously mark positions. A commercial basis still exists, but it is not quoted in the same way as a wheat basis to Matif or a freight basis to an FFA route.

Wood pellets can be valued as an energy input for power plants. Their economics may be compared with gas, power, coal, carbon and renewable subsidy regimes. However, this does not mean that a pellet position can be cleanly hedged with gas futures. Gas is a competing energy reference, not a direct hedge. The wood pellet price contains risks that gas futures do not capture: fibre supply, drying costs, plant outages, sustainability certification, storage losses, moisture, calorific value, port handling, inland logistics, ocean freight, counterparty performance and regulation. Therefore, the pellet-to-gas spread is observable as an economic relationship, but it is difficult to trade, price or hedge as a standard financial spread.

The consequence is that biomass markets manage risk through contract design rather than exchange hedging. Instead of quoting a transparent basis to a liquid futures benchmark, the market embeds the basis inside bilateral contracts. Fixed-price term contracts, index-linked formulas, freight pass-throughs, quality adjustments, take-or-pay clauses, volume tolerance, sustainability clauses, credit terms and long-term supply agreements become the main risk-management tools. In other words, the biomass basis is not traded on a screen; it is negotiated into the physical contract.

This has kept the market more contractual, less transparent and less liquid than comparable energy and agricultural commodity markets. In a liquid market, a trader can buy physical product, sell a futures contract, monitor basis exposure and exit the position if risk limits are breached. In biomass, that mechanism is weak. Positions are often bilateral, bespoke and difficult to unwind. The trader may know the commercial logic of the position, but the risk department may still struggle to verify the mark-to-market, estimate volatility or observe a reliable exit price.

This matters because larger trading houses run formal risk systems. They allocate capital through position limits, stress tests and Value at Risk models (Pirrong, 2015). These models need observable price history, liquidity assumptions and hedge correlations. Biomass often fails this test. If a wood pellet cargo cannot be marked against a liquid futures curve, and if there is no reliable hedge to offset the exposure, the model either assigns a punitive risk charge or refuses to recognise the hedge value. The commercial desk may see an attractive margin, but the risk system sees illiquid directional exposure.

Therefore, larger traders often need to structure biomass trades in one of three ways.

First, they can execute back-to-back business, buying from a supplier only when the sale to a consumer is already secured. This reduces price exposure but also reduces trading optionality. Second, they can keep positions small enough that the unhedged risk does not break internal VaR limits. This protects the balance sheet but prevents meaningful scale. Third, they can use long-term contracts with matched purchase and sale obligations, where the margin is locked through contract structure rather than through futures hedging. This turns the trader into a supply-chain coordinator more than a basis trader.

The result is a self-reinforcing liquidity problem. Because the market is illiquid, large traders are reluctant to warehouse risk. Because large traders do not warehouse risk, the market remains illiquid. Without active intermediation, there are fewer forward prices, fewer standard contracts and fewer observable spreads. Price discovery remains private, fragmented and relationship-driven.

Biomass trading is therefore not the absence of basis risk. It is basis risk without a clean hedging instrument. The market does not normally hedge wood pellets by selling gas futures and treating the residual as a standard spread. Instead, it controls exposure through bilateral matching, conservative position limits, credit discipline, quality clauses, freight terms and long-term physical agreements. The trader's skill is not only to forecast price direction, but to structure the contract so that the unhedgeable basis remains small enough, measurable enough and profitable enough to fit within the firm's risk framework.

### 6.1.9 Market Participants

Commodity and freight markets are dynamic arenas where various participants trade, hedge and manage the movement of physical commodities across global supply chains (Kingsman, 2000). These markets facilitate the exchange of essential commodities like wheat, corn, soybeans, biomass, energy, metals and other bulk commodities. For each commodity, price formation is closely linked to logistics, freight, storage, quality and timing. Understanding who is active in these markets is crucial for grasping how they function and how prices are determined. The participants can be broadly categorised into either physical participants or financial participants. The distinction is useful, but it is not always clean. A large trading house may trade physical commodities, hedge futures, manage freight exposure and use derivatives at the same time.

As some are hedgers, some are trading flat price and others are trading basis, different market participants care about different risks. Some mainly care about the flat price, while others may be more concerned about quality, logistics or location. This diversity of motives is what makes commodity and freight markets interconnected.

***Physical Participants*** Physical participants are entities directly involved in the production, processing, transportation or consumption of agricultural commodities. They use the futures and options markets primarily for hedging purposes to manage price risk. They buy and sell real commodities in real locations, so they heavily depend on basis.

- Farmers and other producers: They produce commodities and are exposed to price risks associated with market volatility. In agricultural markets this includes producers of wheat, maize, soybeans, sugar cane, or oilseeds. In other commodity markets it may include miners, energy producers, biomass suppliers or industrial raw material producers.

- Cooperatives: Groups of producers may band together to collectively increase their combined volumes and through that leveraging better terms and market access.
- Multinational Trading Companies: These organisations operate globally, handling large volumes of commodities. They facilitate the movement of goods from producers to consumers, having access to and offering solutions within financing, logistics and risk management that smaller companies cannot.
- Specialised Trading Firms: Some firms focus on specific commodities or regions, providing expertise and market access that might be challenging for smaller producers or consumers to achieve independently. Their advantage often comes from local knowledge, customer relationships, operational expertise or the ability to solve logistical problems that larger firms may overlook.
- Refinery or Processing Companies: Businesses that require raw commodities as inputs for their products hedge against price increases to stabilise production costs.
- Manufacturers and Retailers: Entities further along the supply chain may also participate in the markets to manage their input costs and ensure steady supply.
- Charterers, Shipowners and Freight Traders: These participants provide or procure transportation services. Charterers need vessels to move cargoes, while shipowners provide carrying capacity. Freight traders may take positions in cargoes, vessels or freight derivatives. Their risks include freight rates, bunker costs, port delays, demurrage, vessel availability and route-specific demand.

***Financial Participants*** Speculators are traders who seek to profit from price fluctuations in the commodity and freight markets without any intention of taking physical delivery of the goods. They provide liquidity and are essential for efficient market functioning. By providing liquidity in futures, they also make it easier for commercials to hedge. Their focus is often on price movements, spreads, volatility, correlations and portfolio allocation rather than physical execution.

- Managed Funds and Commodity Trading Advisors (CTAs): These are professional money managers who handle large pools of capital on behalf of clients. They employ sophisticated trading strategies, often using technical models or computer algorithms to make trading decisions. CTAs are regulated entities that must adhere to specific reporting requirements. They rarely engage in physical basis.
- Hedge Funds: Unlike traditional funds, hedge funds may take larger, more aggressive positions in the market. They can engage in both speculative and arbitrage trading, sometimes even taking physical delivery of commodities to exploit price discrepancies.

- Commodity Index Funds: These funds invest in a basket of commodities to replicate the performance of a commodity index. They attract institutional and retail investors interested in diversifying their portfolios.

### 6.1.10 Regulation of Markets

Regulatory oversight is fundamental to maintaining the integrity, transparency and fairness of financial markets. For basis trading, regulation matters because basis depends on trust in price signals. A basis trader compares a physical cash price with a reference price, often from a futures market, index or broker assessment. The more transparent and reliable those reference prices are, the easier it is to judge whether a basis movement reflects genuine conditions.

Commodity futures markets are built around this need for transparency in order to function properly. Futures contracts for agricultural products, metals and energy commodities, are supervised by regulatory bodies such as the U.S. Commodity Futures Trading Commission (CFTC). Regulators monitor trading activity, investigate manipulation and enforce rules on market conduct. Transparency is enhanced through regular reports like the Commitment of Traders (COT), which breaks down the positions held by different types of traders, commercials, non-commercials and non-reportable, helping market participants make informed decisions.

A key feature of commodity futures markets is the use of central clearing houses. All futures contracts are cleared through these entities, which act as intermediaries between buyers and sellers. The clearing house guarantees the performance of the contract, reducing counterparty risk, but at a cost. Participants must post margin, and positions are marked to market daily. Standardised contract terms also support liquidity because participants know the quantity, quality, delivery procedures and financial obligations attached to the contract. For basis traders, this matters because the futures leg of the trade is relatively transparent, standardised and financially secure.

Cash freight markets operate differently. The freight market has traditionally operated on relationships, bilateral negotiation and proprietary information. To this day, most freight transactions are negotiated bilaterally between charterers, shipowners and freight traders via ship brokers. These deals are often relationship-driven, customised and based on information that is not publicly available. This is because freight contracts need to reflect specific vessels, cargoes, ports, laycans, loading rates, demurrage terms or operational risks. However, it also means that price discovery is less transparent than in exchange-traded futures markets.

The treatment of information is one of the clearest differences. In regulated commodity futures and securities markets, insider trading is illegal and subject to severe penalties because it undermines market integrity and investor confidence. In cash freight markets, proprietary information is often part of the trading edge. Freight trading has historically operated through networks, relationships and private information, so information advantages are treated differently from insider trading in securities or regulated futures markets.

These differences underscore the importance of understanding the regulatory frameworks governing different markets. Participants in freight markets must exercise greater due diligence and implement robust risk management practices to navigate the complexities arising from limited oversight. As global trade continues to evolve there may be calls for increased regulation in freight markets to enhance transparency and protect participants, balancing the need for flexibility with the imperative of market integrity.

The European energy crisis of 2022 led European Union member states to agree a market correction mechanism for certain gas derivatives. The mechanism was intended to limit extreme benchmark prices rather than cap the retail price paid by consumers. The agreement set a headline threshold of EUR 180 per megawatt-hour and was due to apply from 15 February 2023. This example shows how regulators may intervene when benchmark prices are judged to threaten market stability, while such intervention can also affect liquidity, price formation and market incentives (Novaya Gazeta Europe, 2022).

However, such price caps can inadvertently affect consumption patterns. By capping prices, consumers may have less financial incentive to reduce their gas usage, potentially maintaining or even increasing demand in constrained markets. This sustained demand, particularly for Russian gas, can contribute to persistently high market prices. Furthermore, elevated energy costs have been linked to a decline in the competitiveness of European manufacturing. Industries faced increased production expenses, leading to reduced output and, in some cases, the relocation of operations to regions with more favourable energy costs. The interplay between price caps, consumer demand, and industrial competitiveness highlights the complexities policymakers must navigate when addressing energy crises. Balancing consumer protection with market stability and economic vitality remains a critical challenge in formulating effective energy policies.

## 6.2 Financial Architecture of Freight Trading

### 6.2.1 Freight Basis Trading

Freight basis trading begins from a simple but important difference compared with many physical commodities: freight is perishable capacity. Grains can be stored and sold later, but an unused vessel day disappears once the day has passed. This changes the economics of basis. In freight, there is no inventory mechanism. The market adjusts through vessel utilisation, speed, congestion, ballast decisions and repositioning. Basis therefore reflects not only the current spread, but also expectations about future vessel earnings and the opportunity cost of using a ship on one employment rather than another.

Modern freight markets operate through two connected layers. The first is the physical chartering market, where ships are fixed for specific voyages, routes, cargoes and laycans. The second is the paper freight market, where exposure to future freight rates is traded through indices and Forward Freight Agreements (FFA). The physical market is negotiated around a specific vessel, route, cargo, laycan and charter-party terms; the paper market is standardised and index-linked. In practice, a physical voyage and a financial hedge are never exactly identical. The hedge can move in the right direction, while still failing to capture the exact economics of the physical voyage. When it comes to economics, the realised margin of a voyage depends not only on the headline freight rate, but also on how the voyage performs. Bunkers, canal costs, port charges, carbon costs, waiting time, weather routing, speed, consumption and vessel performance can all change the final margin. These costs become basis risk when they affect the physical voyage differently from the benchmark used for the hedge. A professional freight trader must therefore ask two questions: does the index match the voyage, and does the voyage perform as expected?

It is also worth-noting that the relationship between the physical route and the benchmark may change over the hedged period. Route basis is therefore rarely constant over time. Differences in local cargo demand, vessels supply, weather conditions, port congestion and regional vessel positioning can cause the spread to widen or narrow and may generate recurring seasonal patterns. Figure 6.5 illustrates the broad monthly shape of route basis is similar across the four years, while its level and amplitude vary from year to year. Historical seasonality can therefore help traders form expectations about future basis movements, but it should not be treated as a mechanical forecast.

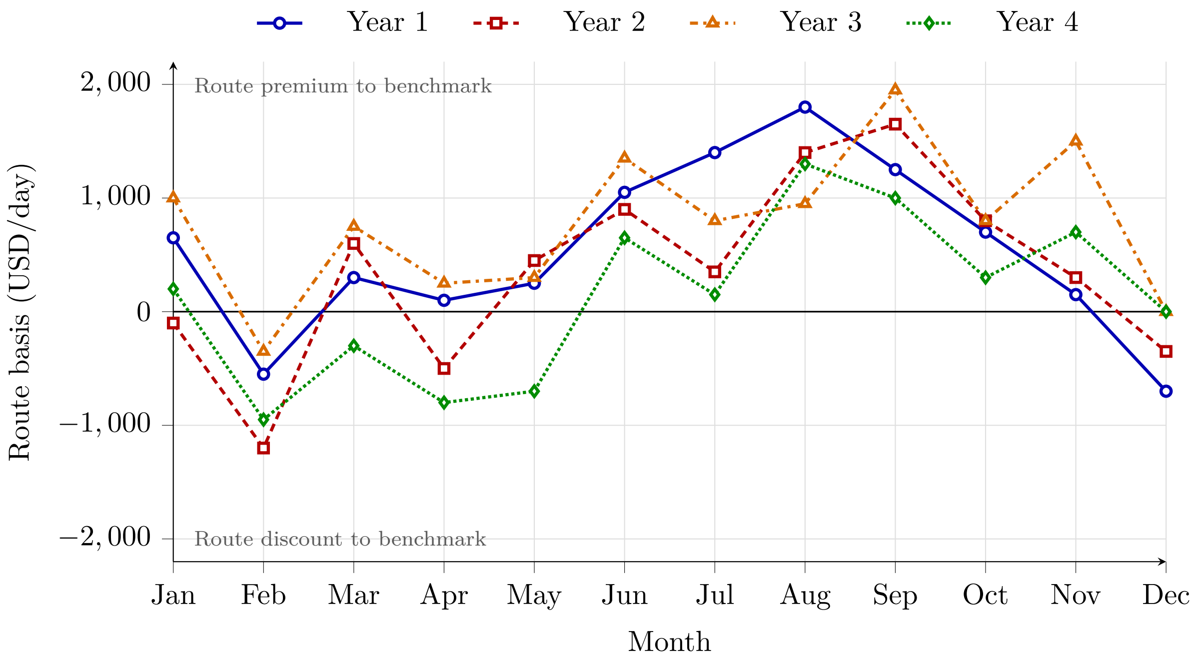



Figure 6.5: Illustrative monthly route basis for a Time Charter trip from region A to region B on a Handysize vessel across four years. Basis is the physical route time charter equivalent less the relevant Baltic Handysize benchmark, measured in USD/day. Positive values indicate a route premium to the benchmark, while negative values indicate a discount. The common monthly shape represents recurring seasonality, while the differences across years represent market conditions specific to each year.

### 6.2.2 Baltic Exchange Freight Indices

Before turning to the details of freight trading, it is useful to first introduce the freight indices on which these instruments depend. Futures markets require standardised settlement benchmarks and freight markets are represented by several index providers. However, for dry bulk and tanker freight derivatives, the Baltic Exchange Indices remain the dominant settlement benchmarks. This section therefore focuses on Baltic Exchange freight indices, particularly those most relevant for commodity supply chains and the FFA discussed below.

The Baltic Exchange itself has a long history. It originated in 1744 at the Virginia and Baltic Coffee House on Threadneedle Street near London's Royal Exchange, where merchants, shipowners and brokers gathered to exchange market information. It was incorporated as a private limited company owned by its members on 17 January 1900. In November 2016, the Singapore Exchange acquired the Baltic Exchange, which continues to operate from London. While this history reflects the evolution of global maritime trade, its modern relevance lies in providing standardised freight benchmarks that support financial hedging. The Baltic Exchange publishes a comprehensive range of freight benchmarks across both the dry bulk and tanker markets. In dry bulk shipping, the principal indices include the Baltic Dry Index (BDI), together with vessel-specific time-charter averages such as the Baltic Capesize Index (BCI), Baltic Panamax Index (BPI), Baltic Supramax Index (BSI) and Baltic Handysize Index (BHSI), as well as individual voyage route assessments. These benchmarks are particularly relevant for agricultural commodities, coal, iron ore, fertilisers and other bulk cargoes. In the tanker market, the Baltic Exchange publishes benchmarks for both crude and refined petroleum products, including the Baltic Dirty Tanker Index (BDTI) and Baltic Clean Tanker Index (BCTI), together with their underlying route assessments. These indices translate fragmented physical freight markets into standardised reference prices, making it possible to trade, hedge and settle freight exposure financially.

FFA rely on these benchmark indices for settlement. This means that the quality, representativeness and interpretation of the underlying index directly affect the effectiveness of the hedge. If the index closely tracks the physical exposure, the hedge performs well. If the index diverges from the actual freight exposure, basis arises. For basis trading, this abstraction matters in several ways. First, the index route weightings may not correspond exactly to actual trading activity. The Capesize 5TC Average Index, for example, assigns weights to selected benchmark routes. Similar weighting structures apply to Panamax, Supramax and Handysize indices. These weights do not necessarily reflect the actual volumes traded on each route at any given time. Although index compositions are periodically reviewed and adjusted, changes in physical trade patterns may occur faster than index revisions. As a result, some routes may be over-represented while others are under-represented. A trader whose physical exposure differs from the index composition is therefore not only exposed to freight price risk, but also to the residual risk between the traded route and the benchmark index.

Second, Baltic freight indices are compiled from broker assessments rather than from a complete set of cleared transactions. This is necessary because freight markets are negotiated, discrete and often relatively thin volume compared with continuously traded financial or commodity markets. Broker assessments bring expert market judgment into the index process, but they also mean that the index is not a pure transaction-price average. This assessment mechanism can also make the index more sensitive to market concentration. In routes or periods where spot fixtures are limited, market information may be concentrated among a relatively small number of brokers and participants. Individual fixtures, assessments or market views can therefore have a larger influence on perceived freight levels. The Baltic Exchange has taken steps over time to strengthen its methodology and governance, but the assessed and discrete nature of freight markets remains an inherent feature of the system.

For basis trading, this creates a potential basis risk, but they may also create trading opportunities for participants who can judge whether the divergence between the index and the physical market is temporary, structural or tradable. Figure 6.6 positions freight against oil on an ordinal opportunity scale, illustrating why freight may offer a smaller market size but potentially higher capture ability. Put differently, freight basis trading raises the question: would one rather be a big fish in a small pond, or a small fish in a big pond?

All of this might read negatively for some, while others might read it as an opportunity. If you have an edge in a market like this, you might reap disproportionate profits. Figure 6.6 compares freight and oil across three dimensions that jointly influence trading opportunity: volatility, market size and capture ability. The figure uses an ordinal radar scale, with each axis scored as low, medium or high from inside to outside. Oil scores medium on volatility, high on market size and low on capture ability, reflecting a large and liquid market where pricing discrepancies are more visible and more quickly arbitraged away. Freight scores low on volatility and market size, but high on capture ability. The implication for basis trading is that freight may offer fewer opportunities in absolute market size, but greater scope to capture specific mispricing or basis divergence. Its less standardised, less liquid and more information-intensive structure rewards traders who understand the physical market, route dynamics and index construction.

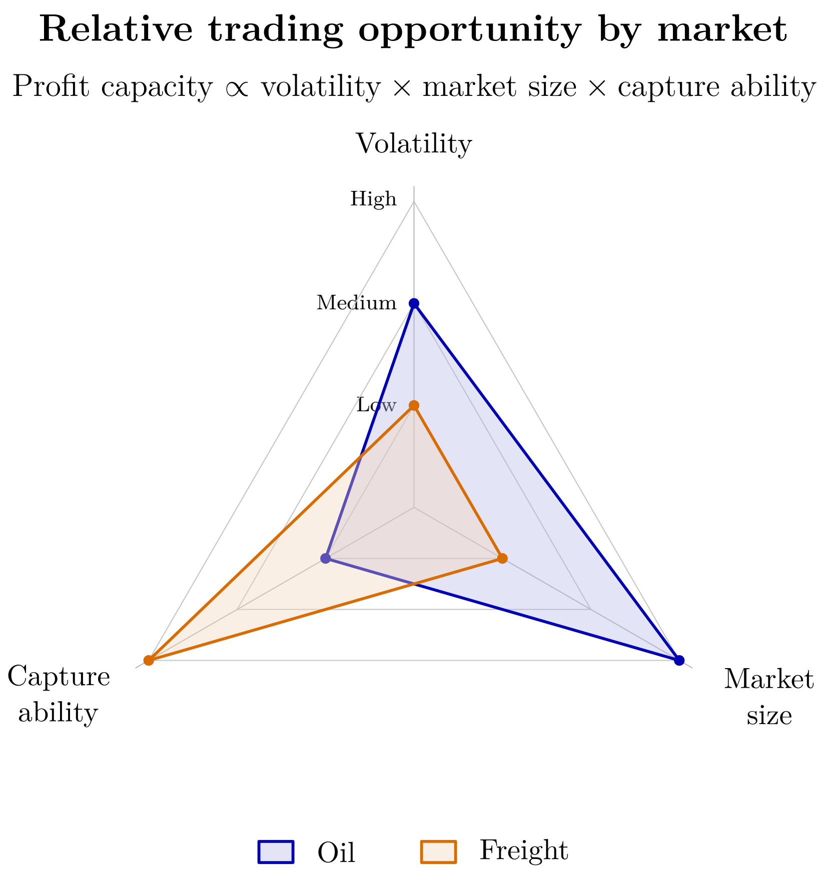



Figure 6.6: Illustrative example of how to think about different markets presented by market on an ordinal radar scale. Each axis is scored as low, medium, or high. Oil scores medium on volatility, high on market size, and low on capture ability. Freight scores low on volatility and market size, but high on capture ability. The shaded areas summarise relative position across axes; they are not estimated profit surfaces. Note that some freight markets can be more volatile than oil, and vice versa.

### 6.2.3 Forward Freight Agreement

Having established the freight basis trading framework, we can now turn to the instrument that makes freight rate risk tradable: the Forward Freight Agreement, or FFA. An FFA is a cash-settled freight derivative linked to a published freight index. It does not move a ship or a cargo. Instead, it allows market participants to exchange an uncertain future freight rate for a fixed benchmark price. In economic terms, this is the key service an FFA provides: it separates the physical act of transporting cargo from the financial risk created by changes in freight rates.

That separation matters because freight is a derived price formed in a volatile physical market, where rates move with changes in shipping demand and vessel supply. In such a setting, shipowners are exposed to uncertain future earnings and charterers are exposed to uncertain future transport costs. The FFA allows both sides to transfer that flat price risk into the paper market without changing their physical trading strategy. A shipowner can stabilise revenues, a charterer can protect a freight budget, and a trader can hedge flat price freight exposure embedded in a CFR cargo sale. The economic gain is better risk sharing: the party that needs freight exposure does not have to keep all of it, and the party willing to bear price risk can take it on.

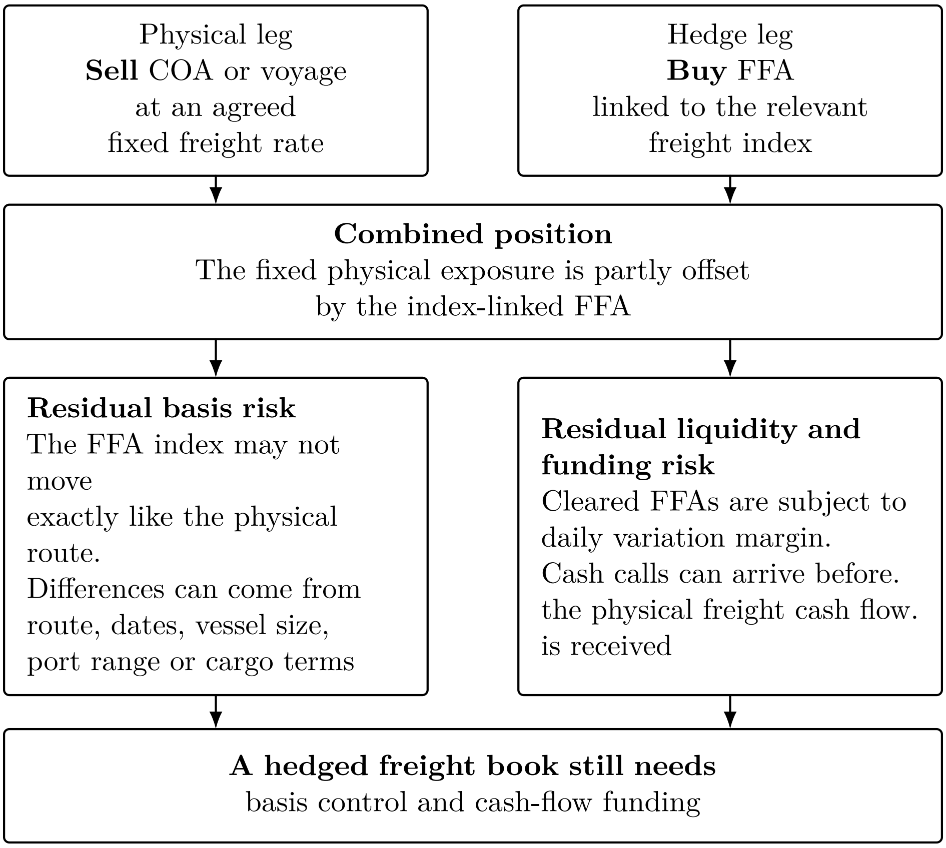



Figure 6.7: An FFA hedge structure.

Figure 6.7 shows this structure. The physical leg may be a fixed voyage, such as a

COA or a voyage sold at an agreed fixed freight rate. The hedged leg is an FFA linked the relevant freight index. Combined, the fixed physical exposure is partially offset by the index-linked FFA. If freight rates rise or fall broadly in line with the index, the hedge helps reduce the benchmark exposure created by the physical leg. However, the figure also shows why an FFA hedge does not eliminate risk. First, the FFA index may not move exactly like the physical route as discussed in the previous section. Second, residual liquidity and funding risk remain because FFA are margined daily. A hedged freight book still needs both basis control and cash-flow funding.

FFA also improve price discovery and make hedging more practical because they translate a messy physical market into standardised financial exposures. At expiry, counterparties settle financially against the published index rather than through the delivery of a vessel. If the market settles above the agreed FFA price, the buyer receives the difference. If the market settles below the agreed FFA price, the seller receives the difference. That is why FFA are the foundation of freight basis trading: they turn uncertain future freight rates into transferable cash flows that can be priced, hedged, and managed separately from the voyage itself.

### 6.2.4 FFA Options

FFA options are another tool for managing freight rate exposure. An option gives the holder the right, but not the obligation, to receive protection if the benchmark move beyond a strike price. A call option protects against rising freight rates, while a put option protects against falling freight rates.

Figure 6.8 shows the commercial logic of FFA options. A charterer who worries about rising freight costs can buy a freight call, which sets a ceiling on the benchmark freight cost. If freight rates rise above the strike, the option gains value and helps offset the higher freight market. If freight rates fall, the charterer can let the option expire and benefit from cheaper freight, losing only the premium paid. A shipowner faces the opposite exposure. A shipowner who worries about falling earnings can buy a freight put, which acts as a floor under the benchmark earnings. If freight rates fall below strike, the option gains value and helps offset weaker earnings. If rates rise, the shipowner can let the option expire and enjoy the stronger spot earnings.

In both cases, the option creates asymmetric payoff. The option buyer pays a premium to limit the downside risk while keeping exposure to favourable price moves. In a basis context, that matters because many traders do not want to neutralise every source of variability. This is also the key difference between an FFA and an option. An FFA creates a more linear hedge against the benchmark risk, where gains and losses move directly with the settlement index. An option, by contrast, protects against adverse benchmark moves while preserving flexibility. The premium is the price of flexibility paid to the writer for bearing nonlinear freight volatility. It is worth noting, however, that an FFA option protects the benchmark, not the exact physical voyage. If the voyage differs from the index because of route, timing, vessel position, port conditions or performance, residual basis still remains.

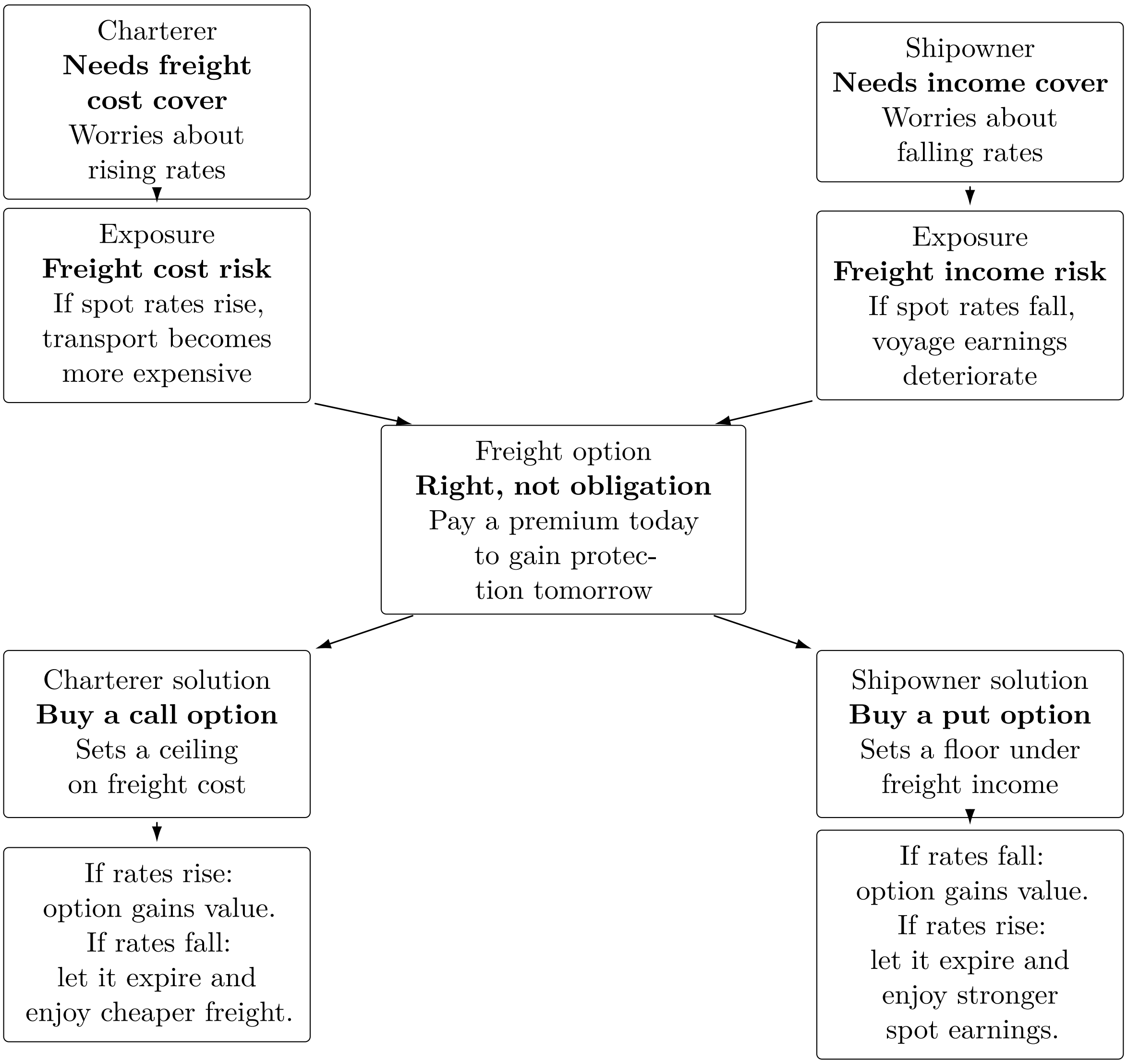



Figure 6.8: Freight options and their usage

A simple freight case shows how this works. Assume a charterer expects to have floating freight exposure linked to a Panamax benchmark. The charterer's internal freight budget is USD 14,000 per day. To protect against a stronger market, the charterer buys a USD 15,000 per day FFA call. The premium is USD 400 per day. During the settlement month, the relevant Baltic average settles at USD 18,000 per day.

The option now has a positive payoff because the settlement index is above the strike price. The call pays the difference between the settlement price and the strike:

$$18{,}000 - 15{,}000 = 3{,}000 \text{ USD per day}$$

After deducting the premium of USD 400 per day, the net option gain is:

$$3{,}000 - 400 = 2{,}600 \text{ USD per day}$$

Now compare this with the charterer's budget. The benchmark moved from the budget level of USD 14,000 per day to USD 18,000 per day. Without the option, this would have created a USD 4,000 per day adverse benchmark move. The option reduces this benchmark loss by USD 2,600 per day. The remaining benchmark cost increase is therefore:

$$4{,}000 - 2{,}600 = 1{,}400 \text{ USD per day}$$

The charterer has therefore not locked freight at USD 14,000 per day. Instead, it has bought protection above USD 15,000 per day, by paying USD 400 per day for that protection. In benchmark terms, the option reduces the impact of the stronger market, but it does not eliminate it completely.

The final step is to separate the benchmark from the physical voyage. Suppose the actual voyage costs USD 18,700 per day because the vessel is poorly positioned, loading is slow, or the route carries extra port risk. The remaining USD 700 per day gap is residual basis:

$$18{,}700 - 18{,}000 = 700 \text{ USD per day}$$

This is why an FFA option should be understood as benchmark insurance, not physical freight insurance.

The example shows the payoff once the option has settled. Before expiry, however, the option value is not fixed. it changes as market conditions change. A call becomes more valuable when the benchmark rises towards the strike, because the protection is more likely to be needed. If the benchmark moves above the strike, the call already has a positive payoff. A put option works in the opposite direction. It becomes more valuable when the benchmark falls towards or below the strike. Time also matters. The longer the period before settlement, the more opportunity there is for the freight rates to move beyond the strike. An option with several months left to expiry will normally be worth more than the same option close to expiry. Volatility also strengthens the value of both calls and puts. Higher volatility means that freight rates move far away from today's level in either direction. For a call buyer, this increases the chance that the benchmark rises above the strike. For a put buyer, it increases the chance that the benchmark falls below the strike. The buyer benefits from favourable larger moves while the downside on the option itself is limited to the premium.

One freight-specific feature is that many FFA options are average-price, or Asian, options. All things else equal, their payoff depends on the average Baltic index assessment over the relevant settlement month, rather than one single final price. This matters because averaging smooths daily rate movements. All else equal, an average-price freight option is generally cheaper than comparable plain-vanilla European options, because one extreme daily move has less influence on the final payoff. This fits freight markets, where options settle financially against index assessments rather than through physical delivery of a vessel.

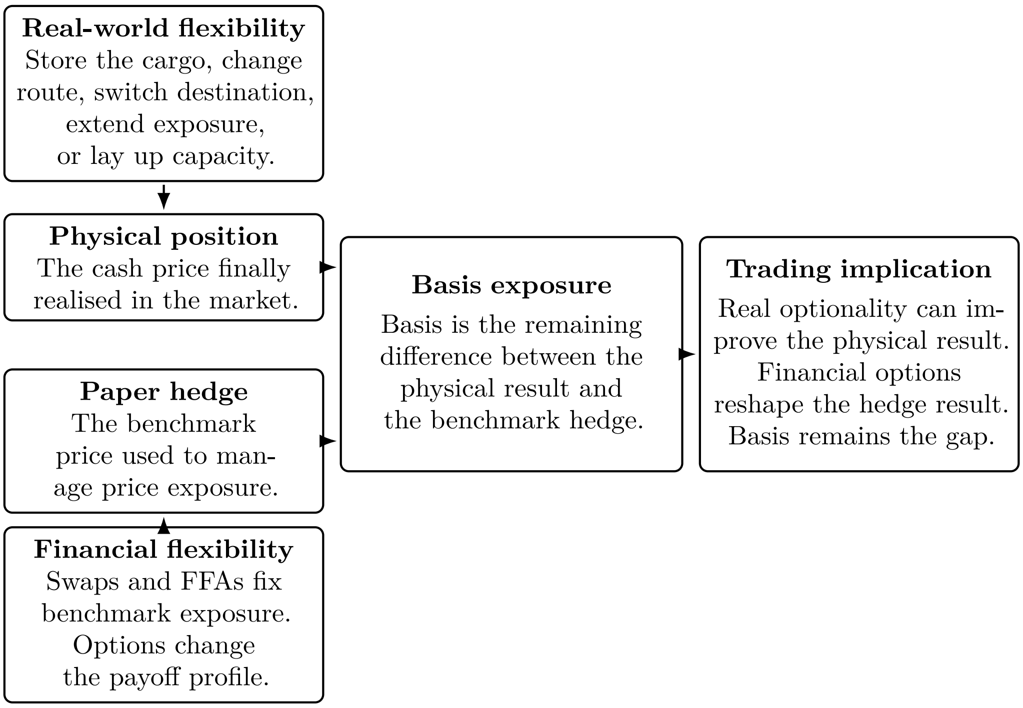



Figure 6.9: Financial and real optionality in freight basis trading

An FFA option is a financial contract written on a freight benchmark. This should be separated from real optionality, which refers to operational choices embedded in a vessel, charter party or logistics position. In shipping, examples include wide redelivery window in time, wide geographical redelivery limits, or the option to extend a time-charter against a fixed rate agreed. Figure 6.9 shows this distinction. Real-world flexibility affects the physical position and can improve the cash result. Financial flexibility affects the paper hedge. Together, both forms of flexibility reshape the payoff, while basis exposure remains between the two that must still be managed.

## 6.3 Strategies for Freight Trading

### 6.3.1 FFA Usage: A Freight Trader's Perspective

Having introduced the mechanisms of FFA, we now turn to how FFA are used from a freight trader's perspective. In this context, a freight trader may include a charterer, commodity trader or freight desk that combines cargo commitments, vessel carrying capacity and paper positions. The central question for the freight trader is not only how to reduce risk, but also how to create value from changing market conditions.

FFA do not create value on their own. Their business value lies in how they reshape the risk profile of an existing or intended physical position. By integrating FFA into their portfolio, freight traders can expand their trading options from simply trading "cargo x vessel" to more complex combinations involving "cargo x vessel x FFA". In the simplest physical market, the trader mainly compares four relative positions: buying cargo, selling cargo, buying vessel tonnage or selling vessel tonnage. Once FFA are added, the trader can also combine these physical positions with long or short paper positions, creating nine trading configurations. This offers trading team multiple avenues to capitalise on market inefficiencies, ultimately driving better performance and unlocking more value within the freight markets.

From this perspective, FFA support four broad commercial decisions. First, they help traders protect the margin of vessel positions that have already been fixed. When a trader charters a vessel on a fixed-rate period contract, the trader faces significant flat price risk due to the predetermined rate. The charter may become expensive relative to the market if freight rates fall. By selling FFA against this exposure, the trader offsets market-wide movements in freight rates. If the market declines, losses on the physical hire may be compensated by gains on the FFA; if the market rises, the FFA loses but the vessel earns more. In either scenario, FFA ensures a fixed price despite market volatility.

Second, FFA allows traders to support forward freight sales and Contracts of Affreightment (COA) commitments before the final execution cost is known. When selling freight or entering COA, the trader may commit to a fixed sale price while the future costs of securing vessel carrying capacity remains uncertain. The trader wants to win cargo business today without being fully exposed to future increase in freight price. In this case, the trader typically sells physical freight and simultaneously buys FFA. This approach prevents being solely short the market and allows for effective hedging by balancing exposure with forward contracts.

Third, FFA help traders transform the pricing structure of an exposure. For floating-rate or index-linked period charters, hire payments move directly with the Baltic Index. This avoids being locked into a fixed hire rate, but it leaves the trader with floating cost exposure. The business problem is that revenues and costs may be priced differently: for example, the trader may have fixed freight income but index-linked vessel costs. By buying FFA, the trader can effectively fix the floating hire exposure into a fixed economic cost. If the index (floating hire) falls, the physical hire decreases which saves the trader money on hire, but the FFA position loses value: if the index rises, hire increases, but the FFA hedge gains value. The purpose is to align the pricing structure of vessel exposure with the trader's commercial commitments.

Fourth, FFA create relative-value and basis trading opportunities. In this case, a freight trader may buy/sell freight for tonnage or cargo based on specific market views. For instance, if anticipating a decline in flat freight prices while observing attractive basis levels from sellers, the trader can speculatively buy freight rates and sell FFA. This strategy locks in the spread between the cargo rate and the FFA, securing potential profits if freight rates or indices decrease as expected. This approach carries risks, as unexpected increases in freight rates could expose the trader to losses.

Across these four cases, the underlying logic is consistent. Freight traders create value by reshaping commercial exposure. What changes is the initial commercial problem: protecting a charter position, supporting a freight sale, aligning pricing mechanisms, or trading a market discrepancy. This is why FFA should be understood not only as hedging instruments, but as strategic tools that expand the commercial possibilities available to freight traders.

### 6.3.2 Basis Management: A Shipowner's Perspective

The previous section examined how freight traders create value through FFA. Shipowners face a different but related challenge. Rather than starting from cargo commitments or trading opportunities, they begin with an existing fleet whose earnings are exposed to freight market volatility.

For shipowners, no fleet earns exactly the same revenue as the benchmark underlying an FFA contract due to differences in trading patterns, routes, vessel specifications, employment duration and fixture timing. In the Capesize freight market, for example, ships may operate on trans-Atlantic, trans-Pacific, front-haul and back-haul, each with distinct rate dynamics. When a shipowner hedges using a composite timecharter average, mismatches between these indices and their fleet's actual earnings arise. The traditional response is to treat this mismatch as a risk to be minimised. This view is useful but incomplete. Basis risk cannot be eliminated entirely, because physical fleet earnings are always more specific than the financial benchmark used to hedge them.

The central question is therefore not only "how do I hedge the market?" but "how can I make the basis more predictable and commercially favourable?" Basis risk is no longer simply an unwanted residual after hedging. Instead, it becomes something that can be actively shaped through operational choices and under certain conditions, turned into a source of profitability. Shipowner therefore reshape exposure through a different set of levers.

The first managerial lever is fleet and route diversification. A vessel or fleet concentrated on one route or region is highly exposed to the specific rate dynamics of that market. By operating vessels across multiple routes, shipowners can average out regional rate discrepancies. Adland and Jia (2017) (Adland and Jia, 2017) found that increasing fleet size reduces basis risk through this diversification effect, with the strongest marginal benefit occurring up to around ten ships. Beyond that point, the benefit continues, but at a diminishing rate.

The second lever is timing diversification. If too many vessels are fixed at the same time, the entire fleet becomes exposed to the same market window. A sudden fall in spot rates may then affect a large share of earnings simultaneously. By staggering fixtures across different times and for varying durations, shipowners create a smoother income stream that is less susceptible to short-term market volatility. Individual voyages may still experience rate volatility, but the fleet as a whole becomes less sensitive to short-term index movements. Timing diversification, when managed deliberately, therefore becomes a source of income smoothing rather than merely a source of mismatch.

The third lever is contract diversification. Different forms of employment expose the shipowner to different types of freight risk. A purely spot-exposed fleet captures market upside but is highly volatile. A fleet locked into fixed-rate period employment has more predictable earnings but may miss upside when the market rises. Index-linked contracts move with the market but still create exposure to benchmark choice and settlement timing. By combining spot voyages, trip charters, period contracts, COAs and index-linked employment, shipowners can shape the earnings distribution of the fleet. FFA can then be layered on top of this contract mix to stabilise income, protect downside, or maintain selective exposure to upside opportunities.

The fourth lever is operational flexibility. A passive fleet simply accepts the basis produced by the market, while an active shipowner can influence realised earnings through operational choices. Shipowners can adjust vessel speeds, optimise fuel consumption, or reposition ships to routes with more favourable rates. Such proactive management allows shipowners to influence realised earnings relative to the hedged positions, turning the basis into opportunities.

Taken together, these levers show that basis risk should not be understood only as a residual risk left over after hedging. For shipowners, basis is embedded in the structure of fleet earnings. It reflects how vessels are deployed, how contracts are written, how fixtures are timed and how financial hedges are layered onto physical operations. Operational decisions and hedging decisions therefore become two sides of the same basis trading framework.

### 6.3.3 The 3x3 Trading Matrix

The previous sections showed the FFA are not isolated financial instruments. For freight traders, they help reshape commercial exposure; for shipowners, they interact with fleet structure, employment choices and operational flexibility to shape basis exposure. The Trading Matrix brings these two perspectives together by analysing interactions between three linked forms of exposure: Freight, Vessel and FFA.

Table 6.1 lists the nine relationships in the 3x3 matrix and links each relative-value trade to its main price, location, calendar or quality risk. In this matrix, Freight refers to physical freight exposure, Vessel refers to vessel capacity or charter exposure and FFA refers to the paper exposure to a market index. Each presents different information in commodity supply chain: current logistics conditions, vessel availability and forward expectations.

The rows show what the trader sells, while the columns show what the trader buys. Each cell therefore represents a relative-value-trade. Rather than asking whether freight rates will rise or fall, the trader asks whether two related forms of freight exposure are correctly priced relative to one another. For example, the FFA for a particular route may appear expensive relative to the current physical freight market. When such pricing relationships deviate from normal market conditions, traders can buy the relatively undervalued exposure and sell the relatively overvalued one, expecting the relationship to move back towards its historical or economic equilibrium.

Constructing a strategy from the matrix involves three steps. First, the trader identifies a misalignment between two exposures. Second, the trader structures a position that buys the undervalued exposure and sells the overvalued exposure. Third, the trader manages the residual basis risk, liquidity risk and margin exposure. This final step is critical. A relative-value trade may be sound in principle but still fail if margin calls force early liquidation, or if the basis widens before it converges.

The value of the matrix lies in its ability to turn complex market interactions into a practical trading map. Rather than treating FFA, Freight and Vessel as separate markets, it shows how they interact. By focusing on relative values instead of absolute prices, the matrix allows traders to identify opportunities, structure hedges and manage risk across the full freight exposure landscape.

| **Sell \ Buy** | **FFA** | **Freight** | **Vessel** |
|---|---|---|---|
| **FFA** | • FFA Shipsize A vs B<br>• FFA Month A vs B<br>• FFA Quarter A vs B | • FFA vs Freight | • FFA vs Vessel |
| **Freight** | • Freight vs FFA | • Freight vs Freight | • Freight vs Vessel |
| **Vessel** | • Vessel vs FFA | • Vessel vs Freight | • Vessel vs Vessel |

Table 6.1: The Trading Matrix

Trading any of the combinations in the 3x3 matrix involves various types of risk, namely:

1. Price Risk: This occurs when the price movements of assets and their corresponding

futures contracts diverge. For example, if an index is under- or overmarked compared to the spot market, it can lead to unexpected losses or gains.

2. Location Risk: Different market locations can exhibit varying levels of volatility. For instance, the Black Sea market in August might be more volatile than the global index, causing discrepancies in performance and risk exposure.
3. Calendar Risk: This risk arises when there is a mismatch between the settlement date of a futures contract and the execution date of the corresponding physical trade. For example, hedging with January contracts but needing to execute in December can create timing issues and potential financial mismatches.
4. Quality Risk: When the physical asset or cargo does not match the specifications of the futures contract quality risk emerges. An example is 38,000 DWT vessel with worse speed consumption than the 38,000 DWT Baltic Exchange index vessel, resulting in valuation errors.

### 6.3.4 Opportunity Cost in Freight Trading

Opportunity cost is central to freight trading because every commercial decision implies giving up another. In volatile freight markets, where rates adjust quickly and freight capacity is mobile for similar services, the trade-off's between choices is not simply between higher or lower rates, but between certainty and optionality. For example, when a shipowner is in the market, freight rates are transparent and competitors are quick to adjust their offerings as all shipowners are presumably offered the same freight rates. A shipowner must consider the opportunity cost of holding out for a higher rate versus accepting a lower but immediately available contract. The intensely competitive environment means that delays in decision-making can result in lost contracts to more agile competitors.

Baltic indices and FFA make these trade-off's measurable. The Baltic indices provide a benchmark for the prevailing physical market, while FFA provide a benchmark for future market expectations. By comparing a physical fixture with these market references, traders and shipowners can quantify the opportunity cost of accepting one commercial decision over another. This measure help make informed decisions about whether to accept a contract or wait for a better opportunity.

This perspective also links naturally to the Trading Matrix. Every relative-value trade represents an opportunity-cost decision. Buying one form of exposure—whether Freight, Vessel or FFA—means foregoing another. Strategic freight trading therefore extends beyond asking whether a freight rate is attractive. The more important question is whether it represents the best available use of capital and freight exposure relative to the alternatives offered by the market.

## 6.4 Key Takeaways

- Basis is the bridge between market analysis and trade execution.

- Freight basis differs from classical commodity basis, but the logic of relative pricing remains the same.
- Derivatives are useful when they are linked to a clear physical exposure or market view.
- Good basis trading depends on understanding the mismatch between index exposure and physical reality.

## 6.5 Connection to the Next Chapter

Basis trading explains *how* relative value is monetised. The next chapter turns to formal risk measurement and pricing discipline, showing how risk appetite can be translated into a freight quote through a VaR-based framework.

# Chapter 7

# Value at Risk Based Pricing

## 7.1 VaR-Based Pricing

Previous chapters showed how commodity and freight traders create value through space, time and form, and how basis explains the gap between physical prices and benchmark prices. In practice, however, not every exposure can be perfectly hedged. The trader must therefore measure the residual basis risk, determine whether it remains within the company's approved risk limits, and decide what premium is required for accepting that risk. This section develops a VaR based framework for cargo positions in which traders are looking to sell freight.

### 7.1.1 Introduction to VaR

Value at Risk, often shortened to VaR, is one of the most widely used techniques for measuring and controlling trading portfolio risk. It estimates a loss threshold over a stated time horizon and at a stated confidence level, subject to the model assumptions and data used. For example, a one day 95 per cent VaR is the loss threshold that the model expects not to be exceeded on approximately 95 per cent of trading days. It is not the maximum possible loss (Frenkel et al., 2005).

VaR has two traditional roles for trading companies. First, it is used to set and monitor risk limits. A company can assign a VaR limit to a trader and then require the exposure to be reduced or rejected if the limit is breached. In this sense, VaR acts as a risk control tool. It tells the company whether a position remains within the approved risk limit. Research finds that traders subject to VaR limits generally take lower risk exposure than unconstrained traders and that the probability of extreme losses is also lower (Cuoco et al., 2008). Second, VaR creates a common denominator for comparing risk across different positions, desks and asset classes. VaR expresses their downside risk in the same monetary language. This makes it easier for top management and risk teams to compare exposures that would otherwise be difficult to assess side by side.

These two roles are especially useful in freight and commodity trading. For a route-specific freight quote, a trader may face several moving prices at the same time, including freight rates, FFA prices, bunker prices, commodity prices, foreign exchange and basis spreads. Each price can move before the trade is completed. The commercial dilemma is: if the freight quote is too high, the company may lose the customer. If the freight quote is too low, the company may accept residual basis risk without being adequately compensated for it. The framework developed here estimates the residual freight basis risk between the physical route and the selected FFA benchmark. Bunker, commodity, foreign exchange, credit and operational risks require separate measurement or risk controls. It also creates a common language between the freight, the commodity and the risk desks. The discussion therefore moves from pure "gut feeling" to a quantified discussion grounded in statistics and market fundamentals. It becomes easier to compare quotes, test against risk limits and decide whether they should be accepted, adjusted or rejected.

### 7.1.2 A Practical VaR Workflow

This chapter explains how the general VaR logic introduced above can be applied to physical quotes in freight trading. Existing research provides the main building blocks for such a framework, but generally treats them separately. The VaR literature explains how trading firms measure downside risk and use risk limits to control positions (Cuoco et al., 2008). The freight hedging literature studies how freight futures and FFA contracts can be used to hedge freight exposure (Alizadeh and Nomikos, 2009). The freight basis risk literature shows that physical freight routes do not perfectly match benchmark indices, leaving residual risk remaining after hedging (Adland and Jia, 2017).

The lack of integration between these research streams creates an important practical challenge. A trader may be able to estimate the overall freight exposure and hedge against the benchmark, but still have no systematic method for quantifying the route-specific basis risk that remains. As a result, residual risk may be under-estimated, and quote decisions may depend excessively on individual judgement rather than a transparent risk framework. This is particularly important in freight markets because even relatively small differences between a physical route and its hedging benchmark can produce losses when applied to large cargo volumes or long exposure periods. This chapter therefore proposes a practical application of VaR that connects benchmark hedging, residual freight basis risk, internal risk limits and physical pricing.

Figure 7.1 gives a high level map of the workflow. Steps 1 and 2 define the exposure and select the market driver. The workflow then separates into two parallel branches. Branch A estimates the forward TC rate, expected forward route basis and allowed VaR for the route and month under consideration. Branch B independently estimates the hedge ratio, historical hedged basis changes and residual basis VaR. Step 6 brings the branches together by comparing residual basis VaR with allowed VaR. If the quote passes the policy gate, Step 7 adds the residual basis risk premium and forms the final quote.

The method is organised into seven steps:

1. Input configuration
2. Market driver selection

3. Branch A: Forward TC, expected basis and allowed VaR estimation
4. Branch B: Hedge ratio estimation
5. Branch B: Residual basis VaR estimation
6. Policy gate and hedge decision
7. Pricing risk premium and final quote

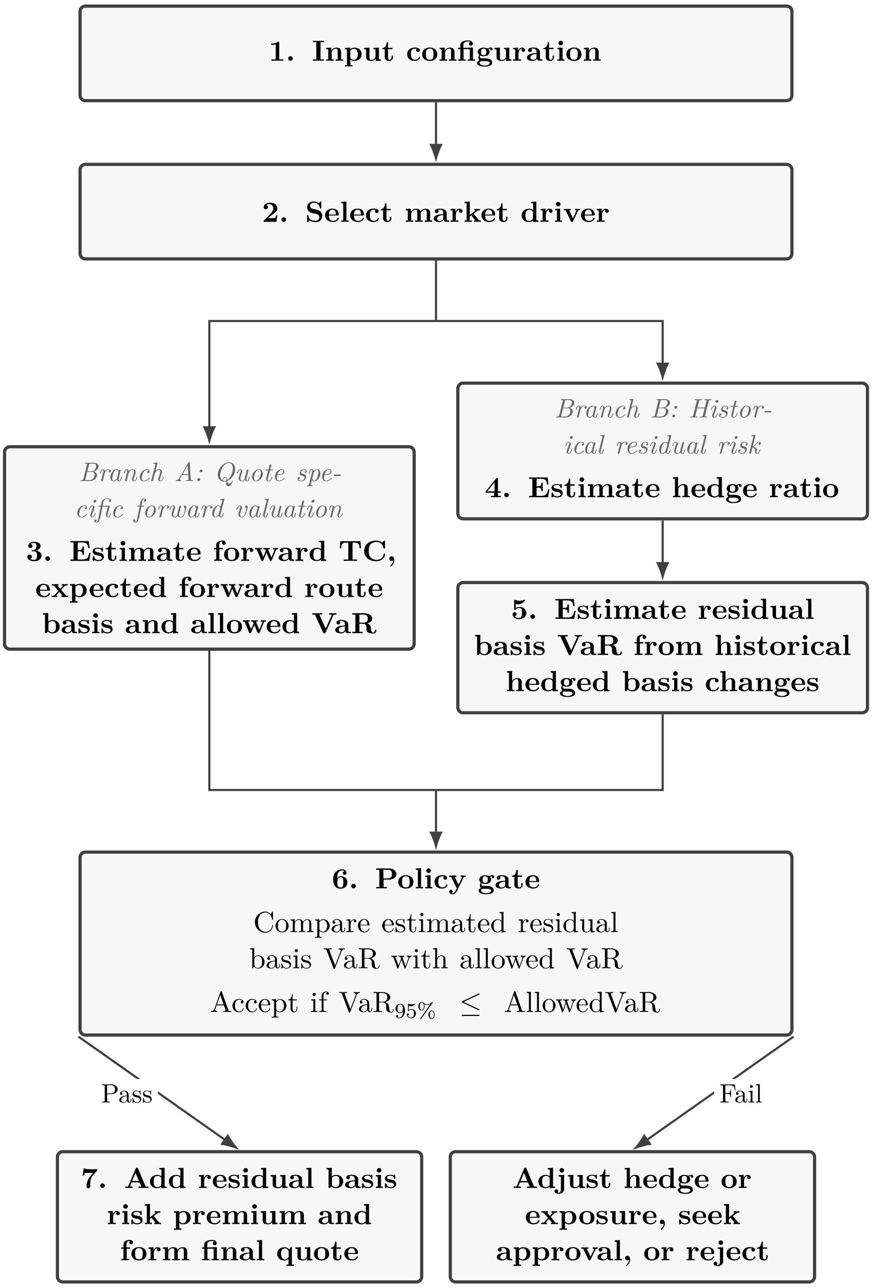



Figure 7.1: Parallel workflow for VaR based freight pricing. Branch A estimates the quote specific forward value and allowed VaR. Branch B independently estimates residual basis VaR from historical hedged basis changes. The two outputs meet at the policy gate.

### 7.1.3 Method Specification

**Step 1: Input Configuration**

***Select the target route and TC series.*** The trader first identifies the physical route to be priced and hedged. The daily TC rate for this route is expressed in USD/day.

***Select the hedge month.*** Next, select the hedge period, usually a calendar month denoted by $M$. Other key parameters are all anchored to this month.

***Load data inputs.*** The trader then loads the required data:

- Weekly historical TC assessments (USD/day) for the selected route;
- Daily historical Baltic index settlements for a set of indices that could serve as candidate drivers with dates matching the weekly observations;
- Current FFA forward market quotes (USD/day) for the hedge month $M$, settling on those Baltic indices.

**Step 2: Market Driver Selection**

The goal of this step is to identify a market index that best tracks the target route. This index is called the market driver. Candidate drivers may include relevant Baltic route indices. To select the driver, the trader compares the historical relationship between the target TC rate and each candidate index. In practice, the Pearson correlation between the two series will be calculated for this purpose. Compared with alternative correlation measures, Pearson correlations are consistent with the linear regression framework used later, ensuring methodological consistency. However, the two series must be prepared so that their correlation reflects a stable and meaningful relationship.

***Weekly to Daily TC Time Series.*** Physical cash route TC assessments are in the dataset collected on a weekly basis, whereas Baltic indices and FFA prices are available on business days. To compare them, the weekly TC series must first be converted into a daily time series. The simplest approach is to carry each weekly TC quote forward until the next quote is published. For example, if the TC rate is USD/day 13,000 on 12.03.2025 and the next quote of USD/day 13,500 appears on 22.03.2025, then each calendar day in between these two dates is assigned the USD/day 13,000. This methodology impacts our results, but we consider it preferable to interpolating values between dates for the weekly observations as this would average-out the volatility.

***Monthly Average.*** The daily series is then converted into monthly averages. This reduces daily noise and makes it easier to compare the co-movement between the target TC rates and the Baltic indices. For the target route, TC quotes are carried forward until the next quote is published, its monthly average is therefore time-weighted. It means, within a given month, each quote is weighted by the number of calendar days for which it remains valid. For example, a quote valid for 10 calendar days receives a weight of 10, while a quote valid for 6 calendar days receives a weight of 6.

For Baltic indices, the monthly average is calculated as the simple average of all daily settlement prices observed during the month. In other words, each settlement is equal in weight. Non-trading days are not included because no settlement price is published on those days.

***Month-over-month (MoM) Changes.*** After the monthly averages of TC and Baltic indices have been calculated, both series are converted into month-over-month changes. This is because driver selection should test co-movement, not similarity in absolute price levels. A Baltic index may trade at a different USD/day level from the TC route, but it can still be a suitable driver if the two series rise and fall in a consistent way. Their month-over-month percentage changes are:

$$\mathrm{x}_m = \frac{\overline{\mathrm{TC}}_m}{\overline{\mathrm{TC}}_{m-1}} - 1, \qquad \mathrm{y}_{i,m} = \frac{\overline{I}_{i,m}}{\overline{I}_{i,m-1}} - 1, \qquad m = 2, \ldots, T.$$

The model only compares periods where both series have valid observations. Importantly, if the effective number of observation pairs falls below a minimum threshold (for example, fewer than 12 observations for a year), the series should not be used to avoid incomplete interpretation based on fewer observations.

***Rolling Correlations.*** These two series of month-on-month changes are then used to calculate the Pearson correlation for selecting the market driver. However, a single full-sample correlation is not enough because the relationship between a Baltic index and a specific TC route can change over time. A hedge may work well in some years and poorly in others. For this reason, the model uses rolling correlations. Rolling correlations test whether the relationship remains stable across different market conditions rather than merely appearing strong over the full sample.

A rolling correlation calculates the correlation repeatedly over a moving time window. For example, a 12-month rolling correlation first measures their correlation over months 1 to 12, then months 2 to 13, then months 3 to 14, and so on. This produces a time series of correlation values. The trader can then see whether the relationship stayed strong, weak or broke down.

Different window lengths are used. A 12-month window is more responsive to recent market changes, but it can also be noisy. A 24-month window gives a more balanced view between recent behaviour and medium-term stability. A 36-month window is slower to react, but it gives a more robust view of the longer-term relationship. Using several windows helps avoid selecting a driver that only looks good in one test. A good driver should perform reasonably well across short, medium and longer windows. The correlation calculation is therefore repeated over 12-, 24- and 36-month rolling windows.

***Driver Selection Rule.*** The driver is selected by comparing the rolling correlation results across all candidate indices. A good driver should meet two conditions: it should exhibit both a *high* correlation with the TC route and this correlation should be *stable* across the 12-, 24- and 36-month windows. In practice, the trader compares the average rolling correlation, the variability of that correlation, and the recent correlation trends. The preferred driver is the index that moves most closely and most consistently with the physical route.

The framework uses historical prompt month values because it assumes that the freight position remains open until physical execution. For quotes made well before execution, the calibration should instead use historical FFA contracts with a remaining tenor comparable to the position being priced.

### Step 3: Forward TC, Basis and Allowed VaR Estimation

***Historical Levels Regression.*** Once the driver index has been selected, the next step is to estimate how the target TC rate has historically priced relative to that driver. This step uses the same TC and driver series in daily level form as introduced in Step 2. Let $\mathrm{TC}_t$ denote the historical TC rate (USD/day) for the target route on business day $t$ and $\mathrm{Driver}_t$ denote the daily level of the selected driver index on the same day. The model estimates this relationship with a simple linear regression as:

$$\mathrm{TC}_t \;=\; \alpha \;+\; \beta\,\mathrm{Driver}_t \;+\; \varepsilon_t$$

The coefficient $\beta$ measures how strongly the TC rate tends to move with the driver in levels. For example, if $\beta = 1.20$, a USD 1,000/day increase in the driver has historically been associated with an average USD 1,200/day increase in the target TC route. Figure 7.2 illustrates this estimate. Each dot is an observed pair of route TC and driver level. The fitted line shows the average historical relationship between them. The slope of the line is $\beta$.

***Forward TC Estimation.*** The regression equation above describes the historical relationship between the target TC route and the selected driver. The next step is to apply this relationship to the forward market. The selected FFA contract provides a forward market price for the driver. The trader can therefore use the FFA quote as the forward input in the model. Let $F(M)$ denote the current FFA quote for month $M$, implying the forward level for that driver. By inserting $F(M)$ into the regression equation, the model estimates the forward TC rate for the target route:

$$\mathrm{TC}^{\mathrm{fwd}}(M) \;=\; \alpha \;+\; \beta\,F(M)$$

Here, $\mathrm{TC}^{\mathrm{fwd}}(M)$ is the model-estimated forward TC rate, not a guaranteed market price. This projection assumes that the historical relationship between the target route and the FFA index remains informative for the hedge month. The estimation should therefore be reviewed when structural or market conditions differ materially from the historical period.

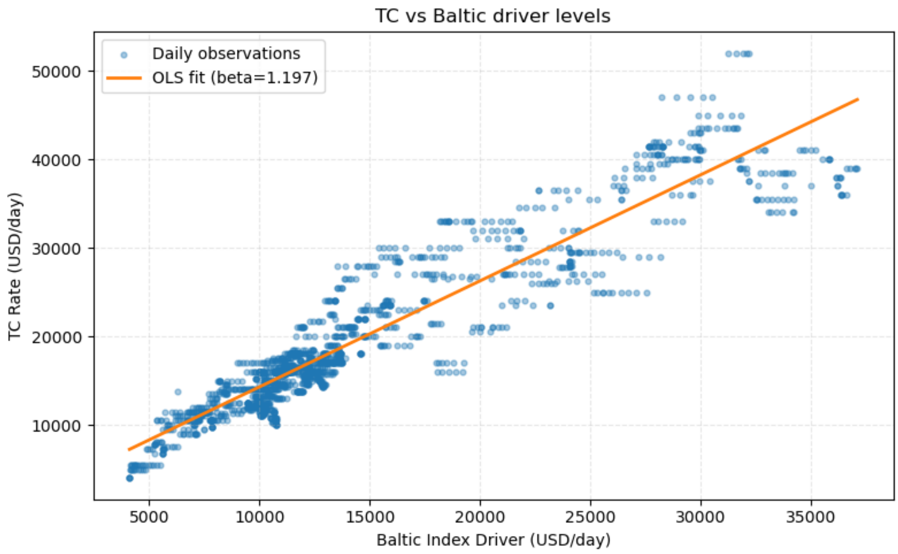



Figure 7.2: Historical relationship between route TC and selected Baltic driver.

***Expected Forward Route Basis.*** The expected forward route basis is defined as the difference between the model-estimated forward TC rate for the target route and the current FFA quote for the selected driver:

$$\text{Basis}^{\text{fwd}}(M) \;=\; \text{TC}^{\text{fwd}}(M) \;-\; F(M)$$

A positive expected forward basis means that the target route is expected to price above the FFA benchmark. A negative basis means the target route is expected to price below the FFA benchmark. The basis is expressed in USD/day.

***Allowed VaR.*** The expected forward route basis is then converted into a quote specific policy limit. Let $g \in (0,1)$ denote the company's risk budget parameter. The allowed VaR is:

$$\text{AllowedVaR} = g \cdot \left|\text{Basis}^{\text{fwd}}(M)\right|$$

The expected forward route basis is used as the scaling reference because it represents the expected difference, in USD/day, between the physical route and the FFA benchmark for the route, month and quote under consideration. The parameter $g$ specifies the proportion of this expected difference that the company is willing to accept as residual basis risk.

For example, if $g = 10\%$, the allowed VaR equals 10 per cent of the absolute expected forward route basis. This scaling rule is an internal policy choice rather than a statistical relationship between expected basis and residual volatility.

Where the company also applies an absolute daily cap $V_{\max}$, the policy limit becomes:

$$\text{AllowedVaR} = \min\Big(g \cdot \left|\text{Basis}^{\text{fwd}}(M)\right|, V_{\max}\Big)$$

### Step 4: Hedge Ratio Estimation

The forward TC rate has now been estimated for the physical route. The next question is how this exposure should be hedged. The challenge is that the FFA contract does not settle against the trader's exact physical route. It settles against the selected Baltic index. In other words, the trader is using a related paper market to hedge a physical freight exposure. Two markets are related but not identical.

This is why the hedge ratio is needed. It shows how strongly the physical route has historically moved when the selected Baltic index moves. For example, suppose that the Baltic index moves by 1,000 USD/day, while the physical route usually moves by USD 1,500/day. A one-for-one hedge would be too small because the FFA hedge would offset only 1,000 USD/day of movement, while the physical route moved by 1,500 USD/day. The trader would still be left with 500 USD/day of unhedged movement. In that case, the hedge ratio would be 1.5. If the physical route usually moves less than the index, the hedge ratio would be below 1, and the trader would use less FFA exposure. The purpose of the hedge ratio is therefore to make the FFA hedge more proportional to the physical exposure. A good hedge ratio reduces the day-to-day volatility of the hedged TC position's profit and loss (P&L).

***Daily Changes.*** To estimate the hedge ratio, the model must compare movements in the physical route with movements in the selected driver. This step also uses a regression between the TC rate and the driver index, but the purpose is different from Step 3. Step 3 used price levels to estimate the forward TC rate level. Here, daily changes in the TC and the driver index are used to estimate the hedge size. This is because hedging is about offsetting movements in profit and loss (P&L), not estimating the price level.

Let $\mathrm{TC}_t$ and $\mathrm{Driver}_t$ denote the daily levels of the TC rate and the driver index, aligned on a common set of business days. The daily change is measured as the difference between today's value and the previous period's value:

$$\Delta\mathrm{TC}_t \;=\; \mathrm{TC}_t - \mathrm{TC}_{t-1}, \qquad \Delta\mathrm{Driver}_t \;=\; \mathrm{Driver}_t - \mathrm{Driver}_{t-1}$$

***Hedge Ratio.*** The hedge ratio, denoted by $\beta_\Delta$ is estimated as the slope in the regression of daily TC changes on daily driver changes:

$$\Delta\mathrm{TC}_t \;=\; \alpha_\Delta \;+\; \beta_\Delta\,\Delta\mathrm{Driver}_t + \varepsilon_{\Delta,t}$$

Note that forward-filled TC observations are excluded from the regression because they do not contain new market information and would otherwise generate artificial zero changes in $\Delta TC$.

This slope measures the historical conditional co-movement between changes in the physical TC rate and the changes in the driver. When applied to hedge sizing, $\beta_\Delta$ tells the trader how much FFA exposure is needed for a given amount of physical TC exposure. If the trader has 100 vessel-days of physical TC exposure and $\beta_\Delta$ =1.5, the model suggests hedging with 150 vessel-days of FFA exposure. In practical application, a common choice is to estimate the hedge ratio over a rolling window of recent history (for example, the last 252 to 520 business days) to reflect current market dynamics.

#### Step 5: Residual Basis VaR

***Hedged Basis Change.*** After hedging based on the estimated hedge ratio, the next step is to measure the risk that the hedge did not capture. The model therefore calculates the hedged basis change:

$$\Delta\text{Basis}_t^{\text{hedged}} \;=\; \Delta\text{TC}_t \;-\; \beta_\Delta\,\Delta\text{Driver}_t$$

where $\Delta\text{TC}_t$ and $\Delta\text{Driver}_t$ are the daily changes defined in Section 7.1.3. The $\beta_\Delta\,\Delta\text{Driver}_t$ represents the movement offset by the FFA hedge. Their difference is the hedged basis change. The model uses daily changes rather than price levels because a high or low basis level does not create a daily gain or loss. It comes from how the basis changes from day to day.

For a freight buyer, a positive value of $\Delta\text{Basis}_t^{\text{hedged}}$ represents a loss because the physical TC cost has increased more than the hedge has offset. A negative value indicates a profit because the physical TC cost has fallen or the hedge has more than offset the increase. The daily loss is therefore defined as:

$$L_t \;= \Delta\text{Basis}_t^{\text{hedged}}$$

Accordingly, $L_t > 0$ represents a loss (in USD/day) on day $t$, and $L_t < 0$ represents a gain.

***One-day Residual Basis VaR.*** VaR has a statistical definition. For a loss variable, the VaR at confidence level $p$ is the empirical quantile of loss distribution at level $p$ (Giot and Laurent, 2003). In other words, VaR identifies the loss threshold that is not exceeded in $p$ percent of the historical observations.

The previous step constructs the historical daily loss variable $\{L_t\}$, where positive values represent losses and negative values represent gains. This historical distribution of $L_t$ (for example the most recent 500 observations) is used to calculate the VaR directly. This approach is called historical simulation VaR because the model uses the historical distribution of $L_t$, rather than assuming a specific statistical distribution. More specifically, the historical outcomes are ranked from smaller to larger values, and the model identifies the loss threshold linked to the chosen confidence level, for example 95 percent.

It is a one-day residual basis VaR because $L_t$ is constructed from daily hedged basis changes. Because losses are recorded as positive numbers, the one-day 95 percent residual basis VaR is the 95th percentile of the historical loss distribution:

$$\text{VaR}_{95\%} = q_{0.95}(L_t)$$

This means the loss threshold was not exceeded in approximately 95% of historical observations. Equivalently, approximately 5% of the observations produced a larger loss. If the one-day 95% residual basis VaR is USD 1,000/day, then approximately 95% of the historical daily losses were no worse than USD 1,000/day, while approximately 5% were worse. It is worth noting that $\text{VaR}_{95\%}$ provides a historical estimate of the residual risk associated with the selected hedge relationship over the chosen estimation period, rather than for the individual quote itself.

The VaR reported here is expressed in USD/day, because it measures the residual basis risk per unit of freight exposure. For a specific trade, this rate based VaR can be converted into a monetary VaR by multiplying it by the number of vessel days represented by the physical and FFA exposure.

***Diagnostic distribution of the historical basis.*** The distribution of historical basis may be asymmetric and may exhibit heavy tails. As a sense check, the trader may also examine the historical pattern of daily *basis in levels*.

$$\text{Basis}_t = \text{TC}_t - \text{Driver}_t$$

Figure 7.3 shows how often the historical basis outcomes fell within a certain range. If most observations are close to the centre, the basis is relatively stable. If the distribution is wide, the basis has moved more sharply. The density curve is the smooth line drawn over the histogram. It shows the same information in a smoother way. The combination of histogram and density gives both a discrete and a continuous view of the typical size and dispersion of the basis, providing economic intuition that complements the one-day $\text{VaR}_{95\%}$.

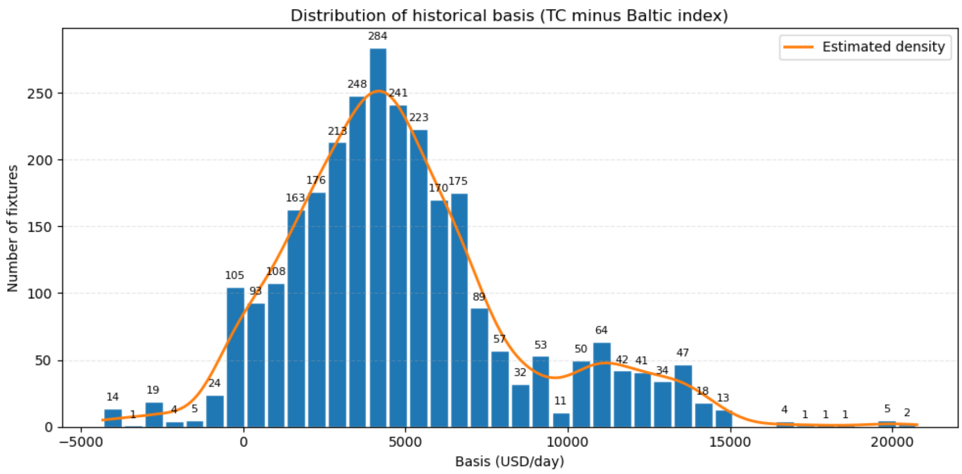



Figure 7.3: Empirical distribution of historical basis levels between the physical route and the selected Baltic driver.

### Step 6: Policy Gate and Hedge Decision

The policy gate brings the two branches together. Branch A provides the quote specific allowed VaR calculated in Step 3. Branch B provides the historical residual basis VaR estimated in Step 5. Step 6 compares these two values to determine whether the proposed hedge and exposure remain within the company's policy limit.

***Hedge Decision Rule.*** Let $\mathrm{VaR}_{95\%}$ denote the one-day 95 percent residual basis VaR estimated in Section 7.1.3. This residual basis VaR provides a historically-based estimate of the residual risk associated with the selected hedge relationship over the chosen estimation period. It is assumed that the historical distribution of the hedged basis changes remains representative of the residual basis risk likely to be faced by the quote under current market conditions. Under this assumption, $\mathrm{VaR}_{95\%}$ serves as a proxy for the prospective residual risk of the quote and can therefore be compared with the quote-specific allowed VaR.

Subject to this assumption, the estimated residual basis risk at 95 percent confidence level is tested against the company's quote-specific policy gate:

- if $\mathrm{VaR}_{95\%} \leq \mathrm{AllowedVaR}$, the expected residual risk of the quote is within the company's risk limit for that quote. The hedge therefore passes the policy gate;
- if $\mathrm{VaR}_{95\%} > \mathrm{AllowedVaR}$, the estimated residual risk of the quote exceeds the company's risk limit for that quote. The hedge therefore fails the policy gate and must be adjusted or rejected.

Figure 7.4 provides a simple visual introduction to this policy gate. The x-axis shows the expected forward route basis, expressed in USD/day. The y-axis shows the one-day residual basis VaR, also expressed in USD/day. Each quote becomes one point. The sloping policy line represents the allowed VaR. In this example, the risk budget $g = 10\%$. The green point below the line passes the policy gate because the VaR is within the approved limit. The red point above the line fails the policy gate because the VaR is too high.

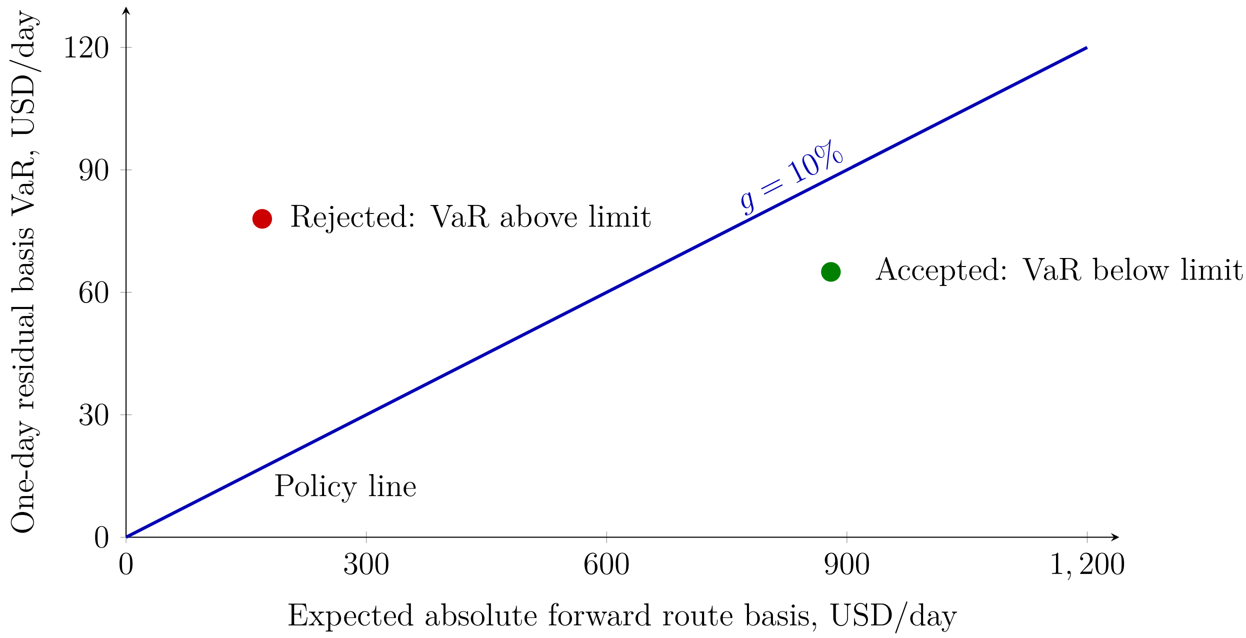



Figure 7.4: A quote is accepted only if hedged VaR sits below the policy line.

In cases of failing the policy gate, the desk may reduce the residual basis risk through various options including, but not limited to:

- selecting a more suitable hedge instrument if the current FFA index does not track the physical route closely enough;
- changing the FFA tenor if the hedge month does not match the physical exposure period;
- reducing the physical exposure by lowering the cargo size, vessel-days or other commitment;
- splitting the exposure across more than one hedge if no single index sufficiently captures the route risk;
- seeking manual approval by management or risk management team if the trade remains commercially attractive despite the policy breach.

### Step 7: Pricing Risk Premium

***Pricing Risk Premium.*** When the quote passes the policy gate, the company moves from risk control to pricing. The policy gate determines whether the residual basis risk is acceptable. The pricing step determines the additional premium required for accepting that risk.

No universal formula converts VaR directly into a price. A company may base the premium on expected loss, capital usage, expected shortfall or another approved internal pricing rule. For this illustrative framework, the company charges a proportion of the estimated residual basis $\text{VaR}_{95\%}$:

$$\text{ResidualBasisRiskPremium} = \lambda \cdot \text{VaR}_{95\%}$$

where $\lambda$ is the company's internal pricing parameter. If $\lambda = 1$, the premium equals the measured residual basis VaR. If $\lambda = 0.5$, the premium equals half of the measured VaR. The quote price is therefore expressed as:

$$\text{TC}^{\text{quote}}(M) = F(M) + \text{Basis}^{\text{fwd}}(M) + \text{ResidualBasisRiskPremium}$$

In practical pricing term, this quote formation can be stated as:

**Time Charter Hire Quote = FFA strip + expected forward route basis + residual basis risk premium**

Here the FFA strip is the benchmark forward freight price for the relevant period and ship size. It is the part of freight exposure that can be hedged through the FFA market. The expected forward route basis captures the expected difference between the physical route and the FFA benchmark. The residual basis risk premium is the amount charged to compensate the company for accepting the residual basis risk.

***Model Output.*** Upon the completion of the hedge evaluation process, the framework produces a small set of quantitative outputs that describe the hedge and its associated risk profile. These outputs are listed below:

- $\text{TC}^{\text{fwd}}(M)$: the forward TC estimate for the target route and month $M$;
- $\text{Basis}^{\text{fwd}}(M)$: the expected forward route basis, showing the expected difference between the model estimated forward TC rate and the FFA benchmark;
- $\beta_\Delta$: the hedge ratio, linking daily TC changes to daily changes in the selected driver;
- $\Delta\text{Basis}_t^{\text{hedged}}$: the hedged basis change, showing the historical residual movement left after the FFA hedge;
- $\text{VaR}_{95\%}$: the hedged one-day 95 percent VaR, expressed in USD/day for one unit of TC exposure;
- the hedge decision implied by the policy gate in Section 7.1.3 .

***Commercial Exception Rule.*** Even though a trade fails the policy gate, it can still be commercially attractive wherefore management may consider an exception if the excess residual basis risk above the VaR limit is compensated by an additional premium, such that the company's potential VaR net loss remains within an approved trade loss limit. This can be achieved by increasing the quoted TC rate and therefore charging more premium.

This exception does not reduce the estimated residual basis VaR or mean that the trade has passed the normal policy gate. Instead, it provides an earnings buffer against future losses and supports the exception for management approval.

For example, suppose an Ultramax trade from ECSA to WCSA has a total one-day residual basis VaR of USD 100,000, while the company accepts a maximum net loss at VaR of USD 50,000 per trade. Charging an additional USD 2,000/day over 25 vessel days produces a risk premium of USD 50,000. The residual basis VaR remains USD 100,000, but the net loss at the VaR threshold becomes USD 50,000 after deducting the premium.

This commercial acceptance rule can be written as:

$$\mathrm{NetLossAtVaR}_{95\%} = \mathrm{ResidualBasisVaR}_{95\%} - \mathrm{ResidualBasisRiskPremium} - \mathrm{ExtraPremium}$$

The exception may be approved when:

$$\mathrm{NetLossAtVaR}_{95\%} \leq \mathrm{TradeLossLimit}$$

The premium does not reduce the underlying market risk. It compensates the company for carrying that risk and absorbs part of the potential loss. Losses beyond the VaR threshold may still exceed both the premium and the trade loss limit.

### 7.1.4 Route Example

The following example uses the seven-step framework for a single Handysize route and forward month using internally consistent placeholder numbers as a numerical illustration of the model's use. In implementation, all quantities are read directly from the production data and notebook. Assume we are in October 2025.

| Input | Value |
|---|---|
| Target TC route | Brazil to Mediterranean (Handysize) |
| Hedge month $M$ | 2026-02 |
| Selected driver | Baltic Handy index $I$ |
| Levels regression | $\alpha = 1{,}500$, $\beta = 0.95$ |
| FFA forward quote $F(M)$ | 12,000 USD/day |
| Daily hedge ratio | $\beta_\Delta = 0.80$ |
| Hedged one-day VaR | $\mathrm{VaR}_{95\%} = 70$ USD/day |
| Risk budget | $g = 10\%$ |

Table 7.1: Inputs for the Handysize route hedging example.

Step 1–3 (Driver and Forward TC Estimate): Using the levels regression, the forward TC for the target physical route in month $M$, based on the FFA quote for the selected Baltic Handy index is:

$$\mathrm{TC}^{\mathrm{fwd}}(M) = \alpha + \beta F(M) = 1{,}500 + 0.95 \times 12{,}000 = \text{ USD 12,900/day}$$

The expected forward route basis is then calculated as the difference between the model-estimated forward TC rate and the FFA benchmark:

$$\mathrm{Basis}^{\mathrm{fwd}}(M) = \mathrm{TC}^{\mathrm{fwd}}(M) - F(M) = 12{,}900 - 12{,}000 = \text{ USD 900/day}$$

This means that the target physical route is expected to price USD 900/day above the selected driver.

Step 4–5 (Hedged Basis and VaR): Based on historical daily changes in TC and the selected driver, the daily hedge ratio is estimated as $\beta_\Delta = 0.80$. The model then constructs the hedged basis change:

$$\Delta\mathrm{Basis}_t^{\mathrm{hedged}} \;=\; \Delta\mathrm{TC}_t \;-\; 0.8\,\Delta\mathrm{Driver}_t$$

The daily loss variable is therefore: $L_t = \Delta\mathrm{Basis}_t^{\mathrm{hedged}}$

Using the historical distribution of loss series, the model estimates a hedged one-day 95 percent VaR of:

$\mathrm{VaR}_{95\%} = USD70/day.$

Step 6 (Policy Gate and Hedge Decision): With a risk budget parameter of $g = 10\%$, the allowed daily VaR is

$$\mathrm{AllowedVaR} = g \cdot \left|\mathrm{Basis}^{\mathrm{fwd}}(M)\right| = 0.10 \times 900 = \text{ USD 90/day}$$

Since $\mathrm{VaR}_{95\%} = 70 \leq \mathrm{AllowedVaR} = 90$, the hedge sized at $\beta_\Delta$ is accepted under the policy gate.
Step 7 (Pricing Risk Premium):

Because the quote passes the policy gate, the company can move from risk control to pricing. The residual basis risk premium is:

$$\mathrm{ResidualBasisRiskPremium} = \lambda \cdot \mathrm{VaR}_{95\%}$$

Suppose that $\lambda = 0.5$. The residual basis risk premium is therefore:

$$0.5 \times 70 = \text{USD } 35/\text{day}$$

The final TC quote is:

$$\begin{aligned} \mathrm{TC}^{\mathrm{quote}}(M) &= F(M) + \mathrm{Basis}^{\mathrm{fwd}}(M) + \mathrm{ResidualBasisRiskPremium} \\ &= 12{,}000 + 900 + 35 \\ &= \text{USD } 12{,}935/\text{day}. \end{aligned}$$

### 7.1.5 Governance and Model Use

Model governance should be built around repeatable actions, documented assumptions and transparent exception handling. The example below is a stylised governance framework adapted from commodity trading practice. It is illustrative and should not be interpreted as standard practice across all shipping companies.

A freight desk could rerun the calibration and VaR computation daily, refreshing the regression window, forward curve snapshot and empirical loss distribution. The model policy should define which changes in coefficients or VaR outputs are material and specify when commentary or approval is required. For example, a change of more than 15 per cent in the hedge ratio could trigger documented analyst review. Traders may exercise commercial judgement on individual quotes only within approved desk limits and exception procedures. They may not exceed the total VaR limit for the trading book without formal approval.

An independent risk department performs deep dives at a defined interval that include back testing of the hedged VaR, stress testing the regression under alternative driver selections, and validation that liquidity thresholds were respected. Scenario libraries covering macro shocks such as fuel price spikes or canal disruptions are periodically refreshed and replayed across the archived hedged basis to confirm resilience. When data gaps or thin FFA liquidity arise, the desk escalates to a manual approval process rather than forcing the model to produce a number. Training notes, governance meeting minutes, and remediation plans are circulated so that process knowledge survives analyst rotation. All artefacts—input data, code versions, regression diagnostics, VaR charts, and hedge instructions—are stored for at least one year to meet internal and regulatory retention policies.

### 7.1.6 Limitations and Cautions

The method inherits the usual limitations of historical-simulation VaR: structural breaks, regulatory shocks, and shifts in fleet deployment can render the past an unreliable guide to the future. Stochastic freight models emphasise the potential for regime changes and volatility clustering, so users should monitor whether the empirical loss distribution shows signs of instability or heavy tails beyond the chosen quantile (Benth et al., 2015). Incorporating scenario analysis, regime classification dashboards, and expected shortfall metrics is recommended when policy frameworks evolve or when management raises concern about tail alignment with corporate stress tests.

Linear hedge scaling delivers intuitive closed-form expressions but can misstate risk when the regression fit deteriorates or the hedge tenor diverges materially from the voyage exposure. In such cases, practitioners should recompute hedged VaR directly, explore multi-instrument hedges, and layer execution cost add-ons before signing off on a quote (Prokopczuk, 2011). Desk users must also be mindful that execution slippage, settlement mismatches, and counterparty credit deterioration are not explicitly modelled; these factors require overlays, possibly in the form of add-on reserves or separate credit valuation adjustments. Finally, the framework assumes that operational logistics (port congestion, bunker delays, laycan adjustments) can be captured through deterministic exposure adjustments, i.e. converting an operational risk into a fixed assumption rather than modelling it as an uncertain distribution. When these assumptions fails the VaR gate should be complemented with scenario-based contingent cash flow modelling.

### 7.1.7 Future Work

Further development can enhance robustness and strategic insight across the modelling chain. Possible extensions include:

1. **Driver selection:** evaluate Bayesian model averaging or sparse machine learning screens to capture multi-factor driver structures while controlling for overfitting.

2. **Regression dynamics:** investigate state-space or regime-switching regressions that allow $\alpha$ and $\beta$ to adapt to structural shifts in freight markets.

3. **Basis modelling:** augment the linear scaling assumption with nonparametric bootstrapping or copula-based dependence structures between TC and FFA series.

4. **Risk metrics:** complement VaR with expected shortfall, drawdown statistics, or filtered historical simulation to better capture tail persistence.

5. **Hedge optimisation:** replace the static hedge ratio with a stochastic programming formulation that includes liquidity, execution costs, and cross-instrument hedges.

6. **Quote strategy:** extend the pricing module to evaluate option overlays (e.g., caps/floors) or customer-specific discount curves that optimise expected margin under VaR constraints.

7. **Portfolio optimisation**: Using expected shortfall models could allow the trader to look at multiple positions from a portfolio point of view, i.e. a hypothesis could be that having both Atlantic and Asian cargo exposures partly offset each other's residual basis risk.

## 7.2 Key Takeaways

- Pricing should reflect both the trader's market view, market competitiveness and the firm's approved risk budget.
- VaR-based pricing is most useful when it is transparent, auditable and easy to communicate across desks.
- Hedging reduces but does not eliminate basis risk; accepted residual risk should inform pricing.
- A model should be treated as a disciplined decision aid, not as a substitute for judgement.

### 7.2.1 Definitions and notation

This section summarises the notation used in the hedging framework. Table 7.2 lists the core time-series variables and derived quantities, while Table 7.3 collects the main model parameters and policy inputs.

| Symbol | Meaning |
|---|---|
| $t$ | Business-day index in the historical sample |
| $M$ | Forward calendar month (hedge period) |
| $\mathrm{TC}_t$ | Daily TC rate (USD/day) for the target route on day $t$ |
| $I_{i,t}$ | Daily level of candidate Baltic index $i$ on day $t$ |
| $\overline{I}_{i,m}$ | Arithmetic monthly average of index $i$ in month $m$ |
| $\Delta\mathrm{TC}_m$ | MoM change (or return) of $\overline{\mathrm{TC}}_m$ |
| $\Delta I_{i,m}$ | MoM change (or return) of $\overline{I}_{i,m}$ |
| $\mathrm{Driver}_t$ | Daily level of the selected driver index on day $t$ |
| $\Delta\mathrm{TC}_t$ | Daily change in TC, $\mathrm{TC}_t - \mathrm{TC}_{t-1}$ |
| $\Delta\mathrm{Driver}_t$ | Daily change in driver, $\mathrm{Driver}_t - \mathrm{Driver}_{t-1}$ |
| $F(M)$ | Current FFA forward quote (USD/day) for month $M$ |
| $\mathrm{TC}^{\mathrm{fwd}}(M)$ | Model-implied forward TC rate for month $M$ |
| $\mathrm{Basis}^{\mathrm{fwd}}(M)$ | Forward basis, $\mathrm{TC}^{\mathrm{fwd}}(M) - F(M)$ |
| $\mathrm{Basis}_t$ | Daily basis level, $\mathrm{TC}_t - \mathrm{Driver}_t$ |
| $\Delta\mathrm{Basis}_t^{\mathrm{hedged}}$ | Hedged basis change, $\Delta\mathrm{TC}_t - \beta_\Delta \Delta\mathrm{Driver}_t$ |
| $L_t$ | Daily loss, $L_t = -\,\Delta\mathrm{Basis}_t^{\mathrm{hedged}}$ |

Table 7.2: Core time-series variables and derived quantities

| Symbol | Meaning |
|---|---|
| $\alpha, \beta$ | Intercept and slope in levels regression $\mathrm{TC}_t = \alpha + \beta\,\mathrm{Driver}_t + \varepsilon_t$ |
| $\alpha_\Delta, \beta_\Delta$ | Intercept and hedge ratio in returns regression $\Delta\mathrm{TC}_t = \alpha_\Delta + \beta_\Delta \Delta\mathrm{Driver}_t + \eta_t$ |
| $w$ | Rolling window length in months for correlation analysis |
| $N$ | Historical window length in business days for VaR estimation |
| $c$ | VaR confidence level (e.g. $c = 0.95$) |
| $\mathrm{VaR}_{95\%}$ | One-day 95% VaR of the hedged basis (USD/day) |
| $g$ | Risk-budget fraction of $\lvert\mathrm{Basis}^{\mathrm{fwd}}(M)\rvert$ allowed as daily VaR |
| $V_{\max}$ | Optional absolute cap on allowed daily VaR (USD/day) |
| AllowedVaR | Policy limit on daily VaR, $\min\Big(g\,\lvert\mathrm{Basis}^{\mathrm{fwd}}(M)\rvert,\, V_{\max}\Big)$ |

Table 7.3: Model parameters and policy inputs

# Chapter 8

# Epilogue

The question that began this book was why freight remains difficult for many commodity traders to use in practice. The answer is not that freight is a separate and unusually technical market. It is that freight consists of multiple pricing components and is often introduced after the commodity decision, when it should be part of the decision from the first price.

Consider one final trade. A buyer in Ivory Coast asks for 30,000 mt of wheat for September shipment. The trader can source from Poland, France or Romania. Each origin has a different FOB price, freight cost, basis exposure and execution risk. The commercial question is not which origin has the cheapest wheat or which route has the cheapest freight. It is which combination produces the cheapest executable delivered cargo.

Freight trading in bulk commodity supply chains is not mastered by reading a book. It is learnt through mistakes, repetition, exposure to markets and the accumulation of judgement. This book should therefore be understood as a first step rather than a final answer. Its purpose has not been to turn the reader into a super trader overnight, but to make the main concepts clearer, more structured, and easier to apply in practice.

The central idea is simple: commodities do not move by themselves. Wheat, corn, soybeans and other bulk products must be financed, priced, transported and delivered before reaching the final buyer. Between the producer and the buyer sits a chain of contracts, vessels, terminals, documents, risks and decisions. Freight connects these moving parts. It is not merely an additional cost considered after the commodity trade has been agreed. It is part of the trade itself, as illustrated by the discussion of FOB, freight and CFR pricing.

Suppose the trader selects Polish wheat as the most competitive executable option. After allowing for the cost of the wheat, freight, finance, documentation and expected execution costs, the trade leaves an estimated margin of USD 2/mt, equal to USD 60,000 on 30,000 mt. The trade appears profitable, but the margin leaves little room for error. A small increase in the FFA, basis or energy component could make the trade unprofitable.

The trader can use wheat futures, FFAs and energy derivatives to reduce exposure to broad movements in wheat, freight and energy benchmarks while assembling the physical trade. These hedges reduce price uncertainty, but they do not remove it. They leave the trader exposed to differences between the benchmarks and the physical trade.

Polish wheat may move differently from the selected wheat future. Freight from Poland to Ivory Coast may move differently from the selected FFA contract. Timing, cargo quality, vessel availability, port performance, documentation, credit and funding also remain uncertain. The hedge itself may require cash through margin calls before payment is received from the buyer.

VaR can help the trader assess whether the expected margin provides sufficient compensation for the measurable risk that remains after hedging. It can support the decision to accept, reject or reprice the trade. However, it cannot measure every operational, documentary or credit risk. These exposures must be managed through contracts, limits, insurance, reserves and commercial judgement.

The commercial work continues after the price has been agreed. The trader must buy wheat on FOB terms in Poland, sell it on CFR terms to a buyer in Ivory Coast and arrange a suitable vessel. The vessel must arrive within laycan. The wheat must be available, meet the agreed specification and pass inspection. The terminal must load the cargo within the contractual allowance, and the shipping documents must conform to the sale contract. Under the assumed sight letter of credit, payment is normally released once the bank has received and checked a complying presentation of clean documents evidencing shipment on board, while the cargo is still in transit. Payment timing differs under usance letters of credit and other payment terms. Under CFR, the seller arranges and pays for carriage to the agreed discharge port in Ivory Coast, while risk in the goods transfers when the wheat is placed on board at the load port in Poland. The estimated margin becomes realised profit only when the entire supply chain performs as expected.

For this reason, the reader should leave the book with a broader view of price. A commodity price is not merely a number observed on a screen. A freight rate is not merely a number quoted by a broker. Both are signals reflecting scarcity, opportunity cost, optionality, expectations and bargaining power. When these prices change, trade flows change. Origins become more or less competitive. Destinations open or close. Margins appear, disappear or move from one participant to another.

The book has tried to show that theory matters because practical trading decisions are rarely isolated events. A trader deciding whether to buy FOB and sell CFR is not only arranging a shipment. The trader is taking a view on freight availability, basis pricing, basis risk, contract timing, port performance, hedge effectiveness, and the behaviour of other market participants. Economic theory helps organise these decisions. It gives the reader a language for understanding why prices move, why risks remain after hedging, and why a trade that looks profitable on paper may fail in execution.

The practical lesson is therefore not that every problem has a clean model answer. Freight and commodity markets are too uncertain for that. The lesson is that better frameworks lead to better questions. What is the real transfer cost from origin to destination? Which part of the margin is commodity basis, and which part is freight? What optionality is embedded in the contract? What exposure remains after the hedge? Is the trader being paid enough for the risk being carried? What has to happen for the trade to work, and what would make it fail?

These questions are useful because they impose discipline. They move the discussion away from vague market opinion and towards structured commercial reasoning. A student or young professional may not yet have the experience to judge every market situation correctly, but can learn to distinguish flat price from basis, freight from commodity value, liquid benchmarks from illiquid physical markets and estimated margin from realised profit.

This is the connection between the chapters. Balance sheets explain why cargo should move. FOB, freight and CFR comparisons show where and when it can move competitively. Basis separates benchmark prices from local physical values. FFAs can reduce exposure to broad freight market movements. VaR helps set the minimum premium required for carrying measurable residual risk.

Freight trading is not the search for certainty. It is the disciplined comparison of relationships under uncertainty. The trader must know which relationship is being traded, which risks have been transferred, which remain and whether the expected margin pays for them.

The hope is that the reader can take something practical away from these chapters. For some, it may be a clearer understanding of how freight enters agricultural commodity pricing. For others, it may be the ability to read a balance sheet differently, to think more carefully about FOB versus CFR exposure, or to understand why FFAs, basis, and VaR are not abstract financial concepts but tools for managing real commercial uncertainty. For others again, the main takeaway may simply be that freight deserves to be part of the trading conversation from the beginning, not added at the end.

This matters because supply chains will not become simpler. Climate volatility, geopolitical disruption, changing trade flows, digitalisation, financialisation, and consolidation will continue to reshape the industry. Future traders will need to combine economic reasoning with practical logistics, data analysis with commercial instinct, and risk control with creativity. They will need to understand both the cargo and the vessel, both the spreadsheet and the contract, both the model and the market.

This book has tried to connect freight economics with commodity trading. Freight is not an additional cost placed beside the commodity trade. It is one of the relationships that determines whether the trade can occur at all. A cargo moves only when origin, destination, freight, finance and execution align. Seeing that alignment, pricing it correctly and preserving it through execution is the work of the trader.

This is the first version of the book. As with any first version, there will be errors, omissions, unclear explanations, and points that deserve improvement. The authors would be grateful to hear from readers who spot mistakes, disagree with an argument or believe that an important practical issue has been missed. A book on freight trading should improve in the same way as a trader improves: by testing ideas against reality, listening carefully, correcting errors, and returning to the market with a better framework.

# Terminology

Definitions in this glossary follow the meaning used in this book. Units are stated where they affect interpretation. Legal, exchange and regulatory terms remain subject to the governing contract, rulebook and applicable law.

## A

| | |
|---|---|
| **ABCD** | Shorthand for the large global agricultural commodity trading groups, classically Archer Daniels Midland, Bunge, Cargill, and Louis Dreyfus, sometimes extended to include other very large traders such as COFCO, Olam and Wilmar which are then abbreviated as ABCD+. |
| **Absolute Advantage** | Absolute advantage is the ability to produce goods more efficiently than others, while comparative advantage focuses on producing goods at the lowest opportunity cost, guiding optimal specialisation and trade. |
| **AIS** | Automatic Identification System used to track ships transporting commodities. |
| **Alpha** | In a linear regression, the intercept term, the expected value of the dependent variable when the explanatory variable is zero. |
| **Anchoring bias** | The tendency to rely too heavily on the first piece of information encountered (the "anchor") when making decisions, affecting subsequent judgments. |
| **APS/DOP** | APS means Arrival Pilot Station, and generally refer to a time charter contract term of where a vessel will deliver. DOP means Dropping Outward Pilot, and likewise refer to a time charter contract term, this time where a vessel will redeliver. Taken together, they are the shortest form of a time charter, i.e. from arrival at the loading port to redelivery at the last discharge port. Alternatively a vessel can deliver at DOP last discharge port, before ballasting to loading port for charterers account. |

**Arbitrage** Buying a good at a lower price in one market and selling it at a higher price in another.

**Arbitration** A private dispute resolution process based on an arbitration agreement, in which one or more arbitrators determine a dispute and issue an award that is normally final and binding, subject to applicable law. In commodity and shipping markets, arbitration is commonly used under sale contracts, charter parties and trade association rules.

**Assets** In commodity trading, assets refer to essential infrastructure like refineries, ports, railroads and storage facilities. These assets enable efficient transportation, processing and storage, providing traders with logistical and competitive advantages.

**Asset school** A view of shipping that treats the vessel mainly as a capital asset and focuses on shipping cycles, fleet supply, leverage, asset values and long term earnings.

## B

**Backhaul** A voyage direction commonly regarded as the return leg relative to a fronthaul. It often earns a lower headline rate, but may improve the vessel's position for subsequent employment.

**Backtesting** The comparison of model estimates with realised outcomes to assess whether the model is correctly calibrated and whether exceptions occur at the expected frequency.

**Back to back position** A matched physical purchase and sale intended to offset volume and broad price exposure, while possible mismatches in timing, location, quality, documents and performance remain.

**Backwardation** Backwardation is a market condition where futures prices are lower than current spot prices, often indicating short-term supply constraints or high demand.

**Balance Sheet** In trading, a market accounting framework that organises available supply, expected demand and the resulting surplus or deficit over a defined period.

**Ballast Cost** Ballast costs refer to the expenses incurred when a vessel sails without cargo, often to reposition for its next load. These costs include fuel, crew and operational expenses, impacting overall shipping profitability.

**Baltic Exchange** A London based membership organisation that publishes shipping market benchmarks and freight indices used for market reference and for FFA settlement.

| | |
|---|---|
| **Baltic freight indices** | A family of freight benchmarks published by the Baltic Exchange. It includes composite indices such as the Baltic Dry Index, vessel class indices such as the BCI, BPI, BSI and BHSI, time charter averages and individual voyage and time charter route assessments. Dry bulk assessments may be quoted in USD per day or USD per metric tonne and may be used for market reference or derivative settlement. |
| **Basis** | The difference between the cash price of a commodity and its futures market price. |
| **Basis - Form** | Basis risk driven by quality, grade, or processing differences between what is hedged and what is delivered or benchmarked. |
| **Basis premium** | The extra amount, positive or negative, over an index or derivative implied value that is required for a physical deal, often set to meet a profit target or a risk limit. |
| **Basis Risk** | The risk that a physical exposure and its hedge do not move together because of differences in benchmark, location, timing, quality, vessel characteristics, contract terms, operations or counterparty performance. |
| **Basis - Space** | Basis risk driven by location differences between the cash commodity and the futures delivery point or benchmark location. |
| **Basis - Time** | Basis risk driven by timing differences, such as seasonality or different delivery months. |
| **Basis trading** | Trading and hedging built around changes in basis, the difference between a cash price and the price of the hedging instrument. |
| **Bear Market** | A downward trend in prices of agricultural products like coffee due to oversupply. |
| **Benchmark** | A standard reference price, rate or index used to compare, value, hedge or settle a physical or financial exposure. |
| **Berth** | A designated place at a port where a vessel lies for loading, discharging, waiting or other operations. A berth may be located alongside a quay, jetty, pier or terminal structure. |
| **Beta** | In a linear regression, the slope coefficient, it measures sensitivity of the dependent variable to changes in the explanatory variable, in this book it is used to size the hedge. |
| **Bid** | The price a grain processor is willing to pay for a bushel of soybeans. |
| **Bill of Lading (B/L)** | A Bill of Lading is a document issued by a carrier to a shipper, |

serving as proof of shipment, a contract for carriage and a title document for goods.

**Broker assessment** A broker's estimate of the prevailing market rate submitted under an index methodology, rather than necessarily being an average of completed transactions.

**Bunker Adjustment Factor** Bunker Adjustment Factor is a legal clause that adjusts freight rates based on fuel price changes, moving energy risk to freight buyers.

**Bunker fuel** Fuel delivered to and intended for use on board a vessel for propulsion or auxiliary machinery. Depending on the vessel and applicable rules, bunker fuel may include residual fuel oil, very low sulphur fuel oil, marine gas oil, liquefied natural gas, methanol, biofuels or other marine fuels.

## C

**Call option** An option giving the holder the right, but not the obligation, to buy the underlying at the strike price or, for a cash settled contract, to receive a payoff when the settlement value exceeds the strike, subject to the contract terms. A freight call can protect a charterer against a rise in the relevant freight benchmark.

**Carbon** In shipping, "carbon" refers to the carbon emissions produced by vessels which are regulated to meet environmental standards, influencing operational costs and sustainability practices.

**Carry In / Carry Out** Carry in is the stock available at the beginning of a defined period, while carry out is the stock remaining at the end of that period.

**Cash-and-Carry Trade** Cash-and-carry trades involve buying a commodity at the spot price, storing it and selling futures contracts. Profits come when futures prices exceed spot plus storage costs, exploiting contango market conditions.

**Cash Commodity** Physical agricultural goods like barley available for immediate delivery.

**Cash Flow** Cash flow refers to the movement of money into and out of a business, showing its liquidity and ability to meet financial obligations.

**Cash Market** A marketplace where farmers sell their harvested crops, such as rice, for immediate payment.

**CBOT** — Chicago Board of Trade, a futures market widely used as a benchmark for North American corn, soybeans and wheat.

**CFR** — Cost and Freight is a commodity term where the seller covers costs and freight, except insurance, to the buyer's designated port.

**CFR matrix** — A table of delivered CFR values by origin and shipment month, calculated by adding aligned FOB and freight values in the same unit.

**CFTC** — Commodity Futures Trading Commission, the United States regulator for commodity futures, options and other derivatives markets.

**Charterer** — The party that hires a vessel or purchases carrying capacity from a shipowner under a charter party.

**Charter Party (CP)** — A Charter Party is a formal contract between a shipowner and a charterer outlining terms for vessel hire, specifying the duration and type of charter arrangement.

**CIF** — Cost, Insurance and Freight is a commodity term where the seller covers costs, insurance and freight to the buyer's designated port.

**Clearing house** — An organisation that provides clearing, netting, margining, settlement and default management for eligible contracts. Where it acts as a central counterparty, it interposes itself between the original counterparties, becoming the buyer to every seller and the seller to every buyer. Clearing may cover exchange traded derivatives and eligible over the counter contracts, including cleared e.g. MATIF or FFAs.

**COA** — Contract of Affreightment, an agreement to carry an agreed quantity of cargo over one or more voyages during a stated period, usually without assigning a named vessel to every shipment.

**Commodity** — A basic physical good, such as grain, oilseeds, sugar, biomass, metals or energy products that are traded in large quantities. A commodity is sufficiently standardised that one unit can generally be exchanged for another unit of the same grade, quality and quantity without materially changing the value received by the buyer or seller.

**Commodity balance sheet** — A market accounting framework in which beginning stocks, production and imports are allocated between domestic use, exports and ending stocks over a defined period.

| | |
|---|---|
| **Commodity basis** | The difference between the cash price of a commodity and the relevant futures benchmark. |
| **Comparative Advantage** | The ability of a party to produce a particular good or service at a lower opportunity cost than others. Influences trade patterns in agricultural commodities. |
| **Complex adaptive system** | A system in which decentralised participants adapt to local information and incentives, causing aggregate outcomes to emerge through feedback rather than central direction. |
| **Confidence level** | The probability threshold attached to a risk estimate. A 95 per cent confidence level means that the VaR threshold is expected to be exceeded on about 5 per cent of observations under the model. |
| **Confirmation bias** | The tendency to seek, interpret and remember information that supports one's existing beliefs, while ignoring contradictory evidence. |
| **Contango** | A term structure where forward or futures prices are higher than the current spot or nearby price, often reflecting storage and financing costs. |
| **Contract Month** | The specified month when a futures contract for soybeans must be settled by delivery or offset. |
| **Contract Theory** | Studies how contracts are designed to align incentives, manage information gaps and ensure optimal outcomes between parties with differing interests. |
| **Convenience yield** | The economic benefit of holding physical inventory that is immediately available for consumption, processing or delivery. |
| **Convergence** | The tendency for the futures price and the relevant cash price to move towards each other as the futures contract approaches expiry, supported by arbitrage and delivery mechanics. |
| **Correlation** | A statistic that measures how two variables move together, often summarised by a correlation coefficient from minus one to plus one. |
| **Cost of carry** | The total cost of holding a storable commodity over time, including finance, storage, insurance, handling, shrinkage and possible quality loss. |
| **COT** | Commitments of Traders report, a regulatory report that groups futures and options positions by participant category. |
| **Counterparty** | A counterparty is the other party involved in a financial transaction, such as a trade or contract, responsible for fulfilling the |

agreement.

| | |
|---|---|
| **Counterparty basis risk** | The risk that default or non performance by the physical counterparty removes the expected cash market offset while the financial hedge remains in place. |
| **Crop Yield** | The amount of crop produced per unit area, a critical measure in agricultural productivity. |
| **Currency Exchange Rates** | The value of one currency for the purpose of conversion to another. |

## D

| | |
|---|---|
| **Deadweight tonnage (DWT)** | The maximum weight a vessel can carry safely, including cargo, fuel, stores, and water. E.g. A 38,000 dwt vessel might only carry 37,230 mts cargo as she carries 770 mts fuel, stores and water. |
| **Deliverable Grades** | Quality specifications for agricultural commodities, such as sugar, that must be met in futures contracts. |
| **Delivery Month** | The month designated for the physical delivery of a commodity, such as oats, under a futures contract. |
| **Delivery point** | An exchange approved location where a futures contract can be delivered, it anchors delivery economics and convergence. |
| **Demand** | The desire for a good (e.g. agricultural products such as corn), affecting their market prices. |
| **Demurrage** | Demurrage is a charge incurred when a chartered vessel is delayed beyond the agreed loading or unloading time, covering the owner's costs for the delay. |
| **Derivative** | A financial instrument like a futures contract derived from an underlying agricultural commodity. |
| **Despatch** | Relates to demurrage. Despatch is a payment from the shipowner to the charterer as a reward for completing loading or unloading faster than the agreed laytime, typically calculated at around half the demurrage rate. |
| **Disintermediation** | The process of removing intermediaries in a supply chain or transaction, allowing direct interaction between producers and consumers. |
| **Draft Survey** | In bulk shipping, a draft survey measures a vessel's displacement before and after loading/unloading to determine the exact cargo weight. |

## E

| | |
|---|---|
| **Econometrics** | Applying statistical methods to forecast crop yields and commodity prices based on historical data. |
| **Economies of Scale** | Cost advantages reaped by companies when production becomes efficient. Relevant in large-scale farming and freight operations. |
| **Edge** | Here understood as trading edge. A trading edge is a strategy that consistently outperforms competitors, such as superior market analysis or faster information access, enabling better decisions which leads to profits. |
| **Efficient Market Hypothesis** | The Efficient Market Hypothesis (EMH) posits that asset prices fully reflect all available information, making it impossible to consistently outperform the market. |
| **Elasticity** | A measure of how much the quantity demanded or supplied of a good changes when its price changes. Important for predicting market reactions to price shifts. |
| **Equilibrium Price** | The market price at which the quantity of a good supplied equals the quantity demanded. Mostly a theoretical concept. |
| **EU ETS** | The EU Emissions Trading System (ETS) limits greenhouse emissions by allowing companies to trade carbon allowances too incentivise carbon reductions across key sectors. |
| **Event risk** | The exposure created by a discrete external shock that changes prices, trade flows, logistics or contractual performance. |
| **Exchange** | A marketplace such as the Chicago Board of Trade where agricultural commodities are bought and sold. |
| **Exchange delivery** | The transfer of an eligible commodity, or the title or delivery documents representing it, under the rules of a physically delivered futures contract. The process connects futures positions to the deliverable cash market and is distinct from cash settlement. |
| **Exchange tender** | The notice and procedure by which a short position holder initiates delivery under a physically delivered futures contract, subject to exchange rules on eligible goods, locations, documents and timing. |
| **Execution risk** | The risk that delays, document errors, quality failures, vessel performance, port problems or counterparty conduct alter or prevent the expected commercial result. |
| **Exercise** | The act of utilizing the right to buy or sell an agricultural |

commodity as specified in an options contract.

**Expected shortfall** The average loss conditional on losses exceeding the VaR threshold, used as a measure of tail risk.

**Expiration Date** The last day an option on a grain futures contract can be exercised by the holder.

**Externalities** A side effect of an industrial or commercial activity that affects other parties without this being reflected in market prices, such as environmental impacts of freight transport.

**Extrapolation bias** The tendency to assume that recent trends or events will continue into the future, often leading to over-optimistic or pessimistic predictions.

## F

**FFA option** A cash settled option linked to a freight index, where a call protects against a rise in the benchmark and a put protects against a fall.

**FFA strip** A combination of monthly or quarterly Forward Freight Agreements used to cover a longer forward period.

**Financialisation** The growing role of financial markets, instruments, institutions, benchmarks and financial performance measures in economic activity and corporate decision making.

**Flat Price** Flat price refers to the outright market price of a commodity, without adjustments for basis or spreads.

**FOB** Free on Board (FOB) is a shipping term indicating that the seller covers costs and risks until goods are loaded.

**Forward Contract** A private agreement to deliver a certain amount of wheat at a predetermined price in the future.

**Forward Freight Agreement (FFA)** A cash settled derivative linked to a specified freight index or route assessment over an agreed settlement period. An FFA transfers exposure to movements in the benchmark, but it does not provide a vessel or guarantee the cost or earnings of a particular physical voyage. Differences in route, vessel, timing, contract terms and performance can leave residual basis risk.

**Freight basis** The difference between a physical freight rate or realised vessel earnings and the relevant freight index or FFA benchmark.

**Freight fallacy** The error of treating the full spread between an FOB price and a delivered sale price, such as CFR or CIF, as ocean freight alone. The spread may also include port and handling terms,

| | |
|---|---|
| | financing, insurance where applicable, timing, quality and basis effects, documentary and execution risk, optionality and the trader's margin. |
| **Freight matrix** | A table of freight costs by origin, destination, route and shipment month, expressed in a common unit for use in delivered price calculations. |
| **Freight Rate** | The cost associated with transporting grains and other agricultural goods from producers to markets. |
| **Fronthaul** | A voyage direction commonly regarded as the higher paying leg in a trading pattern. The headline rate must still be assessed against voyage duration, ballast, costs and the vessel's position after discharge. |
| **Fundamental Analysis** | Evaluating factors like weather and crop reports to predict future prices of agricultural commodities. |
| **Futures Contract** | An agreement to buy or sell a specific quantity of an agricultural product, such as corn, at a future date and price. |

## G

| | |
|---|---|
| **GAFTA** | The Grain and Feed Trade Association, is a global trade association that standardises contracts, arbitration and best practices in the international grain, feed and agricultural commodities market, promoting fair trade. |
| **Game Theory** | Game theory studies strategic decision-making, where individuals' choices impact others' outcomes. It's used in economics to analyse competitive interactions, helping predict behaviours in markets, negotiations and competitive business environments. |
| **Going for the Money** | The "Going for the Money" bias is the tendency to focus on high-reward opportunities, often ignoring associated risks or long-term sustainability. In shipping this is often what is the fronthaul, i.e. a money grabbing leg to a region trading a negative premiums, thus locking in a big positive premium to go there now. |
| **Grading** | Assessing the quality of agricultural products like cotton to determine their market value. |
| **Grain Broker** | A grain broker is an intermediary who facilitates transactions between buyers and sellers of grain, managing negotiations, logistics and market insights. |
| **Grain Elevator** | A storage facility that collects grain from farmers before it is |

sold or shipped.

**Grain Futures** Futures contracts specifically for trading grains such as wheat, corn and soybeans.

**Grain Terminal** A facility where bulk grains such as wheat and corn are stored and transferred for shipping.

## H

**Hedging** The deliberate reduction or reshaping of an identified risk through an offsetting or otherwise compensating exposure. Hedging may use futures, FFAs, swaps, options, physical offsets, matched purchases and sales, or contractual terms. A hedge can reduce benchmark risk while leaving basis, liquidity, credit and execution risk.

**Hedging Pressure** Hedging pressure refers to the impact on futures prices caused by producers and consumers hedging against price risks. Typically, excess selling by producers (or buying by consumers) shifts futures prices.

**Hedging Ratio** The quantity of hedge instrument required per unit of exposure to reduce risk, often estimated from a regression as a beta.

**Herding Bias** The tendency to follow the actions or decisions of a larger group, often disregarding individual analysis or personal judgment.

**Historical simulation** A risk estimation method that uses observed historical market changes or portfolio losses to construct an empirical loss distribution without imposing a specific parametric distribution. VaR can then be estimated from the relevant loss percentile.

**Holding Costs** Expenses associated with storing agricultural commodities, including warehousing and insurance.

## I

**ICE** Intercontinental Exchange, an exchange on which commodity contracts such as Sugar No. 11 are traded.

**Incentives** Incentives are motivators that shape behaviour by aligning actions with desired outcomes. In markets they drive decisions on pricing, efficiency and risk-taking, influencing participants' strategies and overall market dynamics.

**Incoterms** Incoterms, or International Commercial Terms, are globally recognised rules defining responsibilities between buyers and sellers in international trade such as FOB or CIF. They clarify who handles costs, risks and logistics at each stage of delivery, ensuring smooth transactions.

**Initial Margin** The initial deposit required to enter into a futures contract for commodities such as wheat or corn.

**Input Costs** Expenses for seeds, fertilizers and equipment necessary for agricultural production.

**Inspection** Examination of agricultural products to ensure they meet quality standards before export.

**Insurance** Protection against losses due to crop failure or spoilage during transportation of agricultural goods.

**Inventory** Stored agricultural products such as grains awaiting sale or shipment.

## J

**Just-in-Time Inventory** A supply chain strategy where goods are delivered exactly when needed to minimize storage costs at destination.

## K

**Keel** A key structural element of a ship running lengthways along the lower section of the ship's hull, supporting the ship's framework and aiding stability.

**Kernel density estimator** A statistical method that estimates a smooth probability distribution from observed data by placing a kernel function around each observation.

## L

**Laycan** Laycan, or Laydays/Cancelling dates, specifies the time range within which a vessel must arrive to commence loading, with failure to meet dates risking contract cancellation.

**Laytime** The agreed time allowed for loading or discharging under a charter party, used to calculate demurrage when exceeded.

**LIFFE** London International Financial Futures and Options Exchange, a former exchange name still commonly associated with London white sugar contracts.

**Liquidity** The ease with which an agricultural commodity such as wheat can be bought or sold in the market.

**LME** London Metal Exchange, an exchange used for trading and hedging base metals and related contracts.

**Loading** The process of loading cargo, such as grains, onto a vessel for transportation.

**Load Line** A marking indicating the maximum depth to which a ship can be safely loaded with cargo.

**LC (Letter of Credit)** Also called a documentary credit, an LC subject to UCP 600 is an irrevocable undertaking by an issuing bank to honour a complying presentation under the credit's terms. Banks examine documents rather than the goods, services or performance to which the documents relate.

**Logistics** The management of transporting agricultural products from farms to distribution centres and markets.

**LOI (Letter of Indemnity)** In shipping, an LOI is a contractual undertaking intended to indemnify a party that agrees to act without a document or protection it would normally require, for example when a carrier delivers cargo without presentation of an original bill of lading. An LOI does not remove the underlying legal risk, may be unenforceable if it supports unlawful or fraudulent conduct, and is only as reliable as its wording, governing law, signatory authority and the credit of the issuer and any guarantor. Use should follow recommended wording and legal review where relevant.

**Long** A trader who buys futures contracts expecting the price of an agricultural commodity, such as corn, to rise.

**Loss limit** A maximum acceptable loss set by policy for a trade, desk, or portfolio over a given horizon.

## M

**Marginal Cost** The cost added by producing one additional unit of a product. Vital for production decisions in farming and shipping.

**Marginal Revenue** The additional income from selling one more unit of a good. Used to maximize profits in commodity trading.

**Margin Call** A broker's demand for an investor to deposit additional funds to cover potential losses in futures trading.

**Market equilibrium** A price and quantity, or set of prices and quantities, at which planned supply and planned demand are mutually consistent under the relevant market rules and constraints. Equilibrium does not imply that prices are constant or that the market is free from shocks.

**Market Order** An order to buy or sell an agricultural commodity immediately at the best available price.

**Market Structure** Market structure defines how a market is organised, including the number of buyers and sellers, product differentiation and entry barriers. It shapes competition, pricing power and efficiency within an industry.

**Mark to Market** The process of revaluing a position using current market prices, producing recognised gains, losses and possible margin flows.

**MATIF** Marché à Terme International de France, the name commonly used for Euronext agricultural futures such as milling wheat and rapeseed.

**Merchandising** Managing committed physical flows by securing supply, making sales and executing logistics reliably, with the objective of maximising realised margin subject to delivery obligations, basis risk and operational risk.

**Moving Average** A statistical tool used to analyze price trends of commodities like soybeans over time.

**Multimodal Transport** Using multiple transportation modes, such as ship and rail, to move agricultural goods efficiently.

## N

**Nearby Month** The closest expiration month for a futures contract on an agricultural commodity.

**Netback** The value of a commodity at a stated reference point, calculated by taking its value at another point and deducting the specified downstream costs required to move, process or sell it between the two points. A netback is not final profit unless all relevant costs, overheads, risk charges, financing and taxes are included.

**Net Weight** The weight of agricultural goods without any packaging or containers. Important in trading.

**Niche Market** A specialized segment for unique agricultural products like organic grains or exotic fruits.

**Normalcy Bias** Normalcy bias is the tendency to underestimate the possibility or impact of a disaster, leading individuals to assume that things will continue as usual, even in crisis situations.

| | |
|---|---|
| **Notice of Readiness (NOR)** | A formal notice that the vessel is ready to load or discharge, it typically triggers the start of laytime under the charter party. |

## O

| | |
|---|---|
| **Ocean Freight** | The cost associated with shipping agricultural products, such as wheat, by sea routes. |
| **Open Interest** | The total number of outstanding futures contracts for an agricultural commodity such as wheat. |
| **Opportunity Cost** | The loss of potential gain from other alternatives when one alternative is chosen. Crucial in decision-making for resource allocation in agriculture and freight. |
| **Optionality** | Optionality in commodity supply chains provides flexibility to adapt sourcing, logistics and delivery routes based on market conditions, costs, or demand shifts. This adaptability helps manage risks and capture pricing advantages. |
| **Option Contract** | A financial derivative that gives the right, but not the obligation, to buy or sell a commodity, e.g. corn. |
| **Origin** | In commodity trading origin refers to the geographical location where a commodity is produced or sourced, such as a country or specific region. Origin impacts factors like quality standards, trade agreements and logistics, and often influences pricing, availability and transportation routes in global markets. |
| **OTC (Over-the-Counter)** | OTC (Over-the-Counter) hedging involves customised, privately negotiated financial contracts between two parties to manage price risk outside standardised exchanges. Common in commodity trading, OTC hedges provide flexibility in terms, quantities and settlement enabling businesses to tailor risk management to specific exposures. |
| **Overbought (or oversold)** | A market condition where prices of commodities, such as soybeans, have risen too quickly and may decline, or the opposite. |
| **Overconfidence bias** | The tendency to overestimate one's knowledge or abilities, often leading to excessive risk-taking and flawed decision-making. |
| **Oversupply** | When production of an agricultural commodity exceeds demand, leading to falling prices. |
| **Overtrading bias** | Occurs when traders make excessive transactions, often driven by overconfidence or impulsivity, which can increase costs and reduce profitability. |

# P

| | |
|---|---|
| **Percentile** | A value below which a stated percentage of observations lies, subject to the calculation convention used. In a loss distribution, the 95th percentile is the threshold that approximately 95 per cent of observed losses do not exceed. |
| **Perfect Competition** | A market structure characterized by many competitors selling identical products. Leads to price-taking behaviour in commodity markets. |
| **Physical arbitrage** | An executable trade that captures a price difference between physical states after transport, storage, finance, processing, operational costs and risk are included. |
| **Physical contract delivery** | Performance of the delivery obligation under a sale contract. The place and time of delivery, required documents, transfer of risk and other consequences depend on the contract, incorporated trade rules and applicable law. |
| **Physical trading** | The buying and selling of commodities with actual or potential delivery, together with the management of logistics, quality, documents, finance and contractual performance. |
| **Policy gate** | A rule based acceptance check, for example requiring that estimated VaR is below an allowed threshold before a trade is approved. |
| **Port** | A maritime facility where ships dock to load or unload agricultural cargo such as grains and soybeans. |
| **Port congestion** | Delays caused by capacity constraints at ports, such as berth availability, which increase effective voyage time and can tighten vessel supply. |
| **Premium** | The price paid for an option, or an amount by which one price exceeds a stated reference. In an option contract, the premium is paid by the buyer to the seller for the contractual right, whether or not the option is later exercised or produces a positive cash settlement. |
| **Price basis risk** | The risk that the cash price and the futures or index benchmark do not move in parallel after the hedge is established. |
| **Price Discovery** | The process by which market prices for agricultural commodities are determined based on supply and demand. |
| **Price Taker** | A price taker is a market participant who accepts prevailing prices, having no power to influence them, often due to high competition. |

| | |
|---|---|
| **Procurement** | The process of purchasing agricultural commodities, such as grains, from producers for processing or resale. |
| **Profit and loss (PL)** | The net financial result of a position or trade after price changes and relevant costs. |
| **Put option** | An option giving the holder the right, but not the obligation, to sell the underlying at the strike price or, for a cash settled contract, to receive a payoff when the settlement value is below the strike, subject to the contract terms. A freight put can protect a shipowner against a fall in the relevant freight benchmark. |

## Q

| | |
|---|---|
| **Quality Control** | Ensuring agricultural goods meet specified standards before they are marketed or exported. |
| **Quantity Survey** | An assessment of the amount of agricultural commodities, such as wheat, available for trade. |
| **Quay** | A platform lying alongside water for loading and unloading ships carrying agricultural products. |
| **Quota** | A limit on the amount of a particular agricultural commodity that can be produced or imported. |

## R

| | |
|---|---|
| **Rail Freight** | Transportation of agricultural commodities such as corn and soybeans via railroad networks. |
| **Real optionality** | Operational flexibility over route, timing, storage, specification, destination, redelivery or contract extension that can improve the physical result. |
| **Regression** | A statistical method to estimate the relationship between a dependent variable and one or more explanatory variables, used here to link route rates to indices and to estimate hedge ratios. |
| **Residual basis risk** | The risk remaining after hedging because the physical exposure and benchmark differ in route, timing, vessel characteristics, contract terms, operations or settlement. |
| **Risk budget** | The amount of risk allocated to a strategy or desk, often expressed as a VaR limit or loss limit. |
| **Risk management** | The process of identifying, measuring, evaluating, limiting, |

| | |
|---|---|
| | transferring, monitoring and reporting risks so that exposures remain consistent with the firm's objectives, capital, liquidity and approved risk appetite. |
| **Rolling correlation** | Correlation computed over a moving window to track how relationships change over time. |
| **Rolling window** | A fixed length look back period that moves forward through time for repeated calculations, such as correlations or regressions. |
| **Roll Over** | Extending a futures contract by closing the current position and opening a new one with a later date. |

## S

| | |
|---|---|
| **Sentiment** | Market sentiment reflects the overall attitude of investors toward a particular market or asset, influencing buying, selling and price trends. |
| **Settlement price** | The official price set for a contract and day, used for daily settlement and margin calculations. |
| **Shipbroker** | An intermediary who matches shipowners and charterers and assists negotiation and execution of fixtures. |
| **Shipowner** | The party that owns a vessel and earns freight or hire by employing it in the market. |
| **Speculation** | Trading agricultural futures contracts with the aim of profiting from anticipated price movements. |
| **Spot Market** | A market where agricultural commodities such as rice are bought and sold for immediate delivery. |
| **Standard deviation** | A statistic measuring the dispersion of observations around their mean. It is expressed in the same unit as the measured variable and is sensitive to extreme observations. |
| **Stevedore** | A stevedore, or dockworker, is a labourer responsible for loading and unloading cargo on ships at ports and terminals. |
| **Storage Costs** | Expenses incurred for storing crops such as wheat and corn until they are sold. |
| **Stress testing** | The measurement of losses under severe but plausible scenarios that may not be represented adequately in the normal historical sample. |
| **Strike price** | The price or rate specified in an option contract against which exercise or cash settlement is determined. For a call, the cash |

payoff at settlement is based on the amount by which the settlement value exceeds the strike. For a put, it is based on the amount by which the strike exceeds the settlement value, subject to the contract terms.

**Supply and demand** A framework for analysing how planned quantities offered and requested interact with prices. In actual markets, clearing also depends on institutions, contracts, capacity constraints, expectations, information, regulation and bargaining, so the framework is an abstraction rather than a complete description.

**Supply Chain** The entire process of producing and delivering agricultural products from farms to consumers.

**Systemic Causation** Systemic causation refers to outcomes resulting from complex interactions within a system rather than from single, deliberate actions. In freight trading, factors like global demand shifts, fuel costs and regulatory changes collectively influence prices. Recognising systemic causation helps traders understand that market movements often stem from interconnected forces, not individual intentions.

## T

**Tariff** A tax imposed on imported agricultural goods, affecting their market prices and competitiveness.

**TC rate** The time charter daily hire rate, usually quoted in USD per day.

**TC route** A defined time charter trip or route specification used to assess or model daily hire, including the vessel class, delivery area, redelivery area, expected duration and other stated assumptions.

**Technical analysis** The analysis of price, volume, open interest and related market data to identify patterns, momentum, trend or other trading signals. It is a decision tool and does not guarantee future price movements.

**Tenor** The time to maturity of a contract, or the specific contract month, used to describe where on the forward curve a hedge is placed.

**Tick Size** The minimum price movement of a trading instrument such as a futures contract for corn.

**Time charter (TC)** A charter where the vessel is hired for a period at a daily hire rate, with responsibilities split between owner and charterer as specified in the charter party.

**Time charter equivalent (TCE)** A voyage earnings measure that converts net voyage income into an equivalent daily rate. It is generally calculated as voyage revenue less voyage costs, divided by the voyage duration in days. The result depends on the cost, commission, time and operational assumptions used. S

**Tonne mile** A measure of freight demand calculated as cargo volume in tonnes multiplied by transport distance.

**Trading matrix** 3x3 framework that compares relative value across FFAs, physical freight, and vessel markets to structure trading decisions.

**Trading Opportunity Framework, TOF** A structured five-step approach to formulating and evaluating a trade idea – from clearly defining the market opportunity, through setting up hedges and assessing risks, to planning profit targets, exit strategy and execution of the trade.

**Trading school** A view of shipping that treats freight capacity as a tradable flow and focuses on spot execution, timing, access, spreads and optionality.

**Transformation margin** The expected value after transformation, less the value before transformation, execution costs and the required risk allowance.

## U

**Uncertainty** In Knightian terms, uncertainty involves outcomes that are inherently unpredictable and unmeasurable, unlike calculable risks. It reflects unknown probabilities, requiring decision-makers to rely on judgment rather than statistical prediction. Related to risk.

**Underlying Asset** The agricultural commodity, such as wheat, upon which a futures or options contract is based.

**Unloading** The process of removing agricultural cargo from a vessel or vehicle at its destination.

**Upside Potential** The possibility that the price of an agricultural commodity, such as coffee, will increase.

**Utilisation Rate** The extent to which storage or transportation capacity for agricultural commodities is used.

## V

**Value at Risk** An estimated loss threshold for a position or portfolio over a specified period and at a specified confidence level. It is not the maximum possible loss.

**Value Chain** The series of steps involved in producing and delivering an agricultural product to the market.

**Variable Costs** Costs that vary with the level of production, such as fuel expenses in transporting crops.

**Variation margin** The daily cash transfer arising from changes in the marked value of a cleared derivative position.

**Vessel** A ship used in transporting agricultural goods such as grains across seas and oceans.

**Volatility** The degree of variation in trading prices for agricultural commodities over a period of time.

**Voyage charter** A contract under which a shipowner agrees to carry an agreed cargo between stated ports or port ranges in return for freight, subject to the charter party terms. The owner retains possession and navigation of the vessel, while cost allocation, laytime, demurrage and performance obligations follow the agreed charter party.

**Voyage estimate** A calculation prepared before fixing, or updated during execution, that estimates the commercial result of a voyage from freight revenue, commissions, voyage duration, bunker consumption and prices, port and canal costs, waiting assumptions and other voyage costs. It is commonly used to calculate expected TCE and compare alternative employment. The result changes when assumptions or actual performance change.

## W

**Warehouse Receipt** A document that provides proof of ownership for commodities such as grains stored in a warehouse.

**WASDE** World Agricultural Supply and Demand Estimates (WASDE). A monthly USDA report forecasting global commodity supply and demand.

**WCCON, WIFPON, WIPON, WIBON** A shipping phrase referring to the whereabouts of the vessel, meaning "Whether Customs Cleared Or Not. Whether In Berth Or Not. Whether In Free Pratique or not. Whether In Port Or Not".

| | |
|---|---|
| **Weight Note** | A document stating the weight of agricultural goods shipped, crucial for pricing and customs. |
| **Wet Bulk** | Liquid agricultural commodities, such as vegetable oils, transported in large quantities by tankers. |
| **Wharfage** | A fee charged for the use of a wharf in loading or unloading agricultural cargo. |
| **Working capital** | Cash or credit tied up between paying for the commodity, freight and related costs, and receiving the proceeds from the sale. |

## X

## Y

| | |
|---|---|
| **Yield Curve** | A graph showing interest rates over different time horizons. Relevant in financing agricultural operations. |

## Z

| | |
|---|---|
| **Zero-sum Game** | A situation in trading where one party's gain in agricultural markets equals another's loss. |
| **Zone Pricing** | A term sometime used for setting different prices for agricultural commodities based on geographical location. |

# Bibliography


Adland, R. (2003). *The stochastic behaviour of spot freight rates and the risk premium in bulk shipping*. PhD thesis, Massachusetts Institute of Technology.

Adland, R. (2021). Shipping economics and analytics. In Artikis, A. and Zissis, D., editors, *Guide to Maritime Informatics*, chapter 11, pages 319–333. Springer.

Adland, R., Bjerknes, F., and Herje, C. (2017). Spatial efficiency in the bulk freight market. *Maritime Policy & Management*, 44(4):413–425.

Adland, R. and Cullinane, K. (2006). The non-linear dynamics of spot freight rates in tanker markets. *Transportation Research Part E: Logistics and Transportation Review*, 42(3):211–224.

Adland, R. and Jia, H. (2017). Simulating physical basis risks in the capesize freight market. *Maritime Economics & Logistics*, 19(2):196–210.

Ahn, D. (2019). *Principles of Commodity Economics and Finance*. MIT Press.

Alizadeh, A. and Nomikos, N. (2009). *Shipping Derivatives and Risk Management*. Palgrave-Macmillan.

Alizadeh, A. and Talley, W. K. (2011). Microeconomic determinants of dry bulk shipping freight rates and contract times. *Transportation*, 38(3):561–579.

Ammann, D. (2009). *The King of Oil*. St. Martin's Press.

Andreessen Horowitz (2012). Good product manager/bad product manager.

Apple (2025). Consolidated financial statements.

Archer Daniels Midland Company (2024). Our company history. https://www.adm.com/en-us/about-adm/our-company/history/.

Ariely, D. (2008). *Predictably Irrational: The Hidden Forces That Shape Our Decisions*. HarperCollins.

Baltic Exchange (2024). Baltic index documentation for market indices.

Benth, F. E., Koekebakker, S., and Taib, C. M. I. C. (2015). Stochastic dynamical modelling of spot freight rates. *IMA Journal of Management Mathematics*, 26(3):273–297.

Bermpei, T., Ferrara, L., Karadimitropoulou, A., and Triantafyllou, A. (2024). Commodity currencies revisited: The role of global commodity price uncertainty. *Journal of International Money and Finance*, 145.

Blas, J. and Farchy, J. (2021). *The World for Sale*. Penguin (Cornerstone).

Bunge Global SA (2024). Our history. https://www.bunge.com/we-are-bunge/our-history.

Cambridge Dictionary (2026). Supply chain. https://dictionary.cambridge.org/dictionary/english/supply-chain. Accessed 15 July 2026.

Cargill (2024a). Cargill history timeline. https://www.cargill.com/about/cargill-history-timeline.

Cargill (2024b). Our solutions.

Chicago Board of Trade (1999). Understanding basis. https://www.gofutures.com/pdfs/Understanding-Basis.pdf.

Choi, T. Y., Dooley, K. J., and Rungtusanatham, M. (2001). Supply networks and complex adaptive systems: Control versus emergence. *Journal of Operations Management*, 19(3):351–366.

CME Group (2023). The 40-year story of a crude oil benchmark.

Coase, R. (1937). The nature of the firm. *Economica*, 4(16):386–405.

COFCO Corporation (2024). History and honor. https://www.cofco.com/en/AboutCOFCO/HistoryandHonor/.

Corgnet, B., DeSantis, M., and Porter, D. (2015). What makes a good trader? on the role of quant skills, behavioral biases and intuition on trader performance. ESI Working Paper 15-17, Chapman University, Economic Science Institute.

Cuoco, D., He, H., and Isaenko, S. (2008). Optimal dynamic trading strategies with risk limits. *Operations Research*, 56(2):358–368.

Donnelly, B. (2021). *Alpha Trader: The Mindset, Methodology and Mathematics of Professional Trading*. Self Published.

Douglas, M. (2000). *Trading in the Zone: Master the Market with Confidence, Discipline, and a Winning Attitude*. Prentice Hall Press.

Downey, M. (2009). *Oil 101*. Wooden Table Press.

Duke, A. (2019). *Thinking in Bets: Making smarter decisions when you don't have all the facts*. Penguin.

Engelen, S., Dullaert, W., and Vernimmen, B. (2009). Market efficiency within dry bulk markets in the short run: a multi-agent system dynamics nash equilibrium. *Maritime Policy & Management*, 36(5):385–396.

Euronext (2025). Technical specifications of the milling wheat no. 2 futures contract.

European Parliament (2024). The role of commodity traders in shaping agricultural markets.

Fabbe, K., Reinhardt, F., Kindred, N., and Thapar, A. (2018). Ocp group. Case 718-002, Harvard Business School.

Frenkel, M., Hommel, U., and Rudolf, M., editors (2005). *Risk Management: Challenge and Opportunity*. Springer, Berlin and Heidelberg, 2 edition.

Geman, H. (2015). *Agricultural Finance: From Crops to Land, Water and Infrastructure*. Wiley.

Giot, P. and Laurent, S. (2003). Value-at-risk for long and short trading positions. *Journal of Applied Econometrics*, 18(6):641–663.

Goolsbee, A., Levitt, S. D., and Dubner, S. J. (2019). *Microeconomics*. Worth Publisher, 3 edition.

Hager, T. (2008). *The Alchemy of Air*. Crown.

Hedgepoint Global Markets (2023). Grain storage in brazil: Understand the problem.

Hreha, J. (2024). The death of behavioral economics.

Intercontinental Exchange (ICE) (2023). Sugar no. 11 futures contract.

International Chamber of Commerce (2019). *Incoterms® 2020*. ICC Publishing.

Iversen, M. J. and Borup, P. (2024). *Strategy and Business Models in Tramp Shipping: From Financialisation to Digitalization*. CBS Maritime.

Johnson, O. (2022). *40 Classic Crude Oil Trades: Real-life Examples of Innovative Trading*. Routledge.

Kahneman, D. (2011). *Thinking, Fast and Slow*. Farrar, Straus and Giroux.

Keen, S. (2011). *Debunking Economics: The Naked Emperor of the Social Sciences*. Zed Books.

Kingsman, J. (2000). *Sugar Trading Manual*. Woodhead Publishing.

Kingsman, J. (2017). *Commodity Conversations: An Introduction to Trading in Agricultural Commodities*. Self Published.

Kingsman, J. (2019). *The New Merchants of Grain: Out of the Shadows*. Self Published.

Knight, F. H. (1921). *Risk, Uncertainty and Profit*. Houghton Mifflin.

Korzybski, A. (1933). *Science and Sanity: An Introduction to Non-Aristotelian Systems and General Semantics*. International Non-Aristotelian Library Publishing Company.

Kris Johnson Ferreira, J. G. and Valavi, E. (2017). Intermediation in the supply of agricultural products in developing economies. Working Paper 18-033, Harvard Business School.

Lansdale, A. (2015). *Economics of Sea Transport and International Trade*. Institute of Chartered Shipbrokers.

Laulajainen, R. (2007). Dry bulk shipping market inefficiency, the wider perspective. *Journal of Transport Geography*, 15(3):217–224.

Levinson, M. (2006). *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger*. Princeton University Press.

Long, D. (1995). *Oil Trading Manual: A comprehensive guide to the oil markets*. Elsevier.

Long, D. (2001). *Gas Trading Manual*. Woodhead Publishing.

Louis Dreyfus Company (2024a). Heritage. https://www.ldc.com/who-we-are/about-us/heritage/.

Louis Dreyfus Company (2024b). Our value chain. https://www.ldc.com/who-we-are/our-value-chain/.

Lowenstein, R. (2000). *When Genius Failed: The Rise and Fall of Long-Term Capital Management*. Random House.

Mallory, M. T. (2023). Price analysis: A fundamental approach to the study of commodity prices.

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., and Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, 22(2):1–25.

Morgan, D. (1979). *Merchants of Grain*. Viking Press.

Narayanan, A. and Kapoor, S. (2024). *AI Snake Oil: What artificial intelligence can do, what it can't, and how to tell the difference*. Princeton University Press.

Nijs, L. (2014). *The Handbook of Global Agricultural Markets: The business and finance of land, water, and soft commodities*. Springer.

Novaya Gazeta Europe (2022). Eu countries agree on russian gas price cap.

Olam Group (2024). Our history. https://www.olamgroup.com/content/dam/olamgroup/files/uploads/2014/02/1.-Olam-AR-FY15-Overview.pdf.

Oxford University Press (2025). Trading (dictionary entry).

Pirrong, C. (2011). *Commodity Price Dynamics: A Structural Approach*. Cambridge University Press.

Pirrong, C. (2015). *The Economics of Commodity Trading Firms*. Trafigura.

Pirrong, C. (2018). *Commodities Demystified*. Trafigura.

Prokopczuk, M. (2011). Pricing and hedging in the freight futures market. *Journal of Futures Markets*, 31(5):440–464.

Ritchie, H. and Roser, M. (2017). Yields vs. land use: How has the world produced enough food for a growing population? https://ourworldindata.org/yields-vs-land-use-how-has-the-world-produced-enough-food-for-a-growing-population.

Russell, R. (2022). *Price Wars: How the Commodities Markets Made Our Chaotic World*. Doubleday.

Saunders, M., Lewis, P., and Thornhill, A. (2009). *Research Methods for Business Students*. Pearson Education, 5th edition.

Sowell, T. (2014). *Basic Economics: A Common Sense Guide to the Economy*. Basic Books.

Splash247 (2024). Shipping's largest, most fragmented sector faces up to consolidation realities.

Stopford, M. (2009). *Maritime Economics*. Routledge, 3 edition.

Taleb, N. N. (2001). *Fooled by Randomness*. Random House.

Taleb, N. N. (2007). *The Black Swan: The Impact of the Highly Improbable*. Random House.

Taleb, N. N. (2012). *Antifragile: Things That Gain from Disorder*. Random House.

Taleb, N. N. (2018). *Skin in the Game: Hidden Asymmetries in Daily Life*. Random House Penguin.

Thorp, E. O. (2017). *A Man for All Markets: From Las Vegas to Wall Street, How I Beat the Dealer and the Market*. Random House.

Tollens, E. (2011). Soft commodity funds, food price volatility, speculation and public perception: Why soft commodities are a special asset class. Presentation at LICOS Seminar.

TradeWinds News (2019). Danish shipping industry spreads its wings.

Tzu, S. (2008). The art of war. In Mahnken, T. G. and Maiolo, J. A., editors, *Strategic Studies: A Reader*, pages 63–91. Routledge, Abingdon and New York.

Vaughan, L., Finch, G., and Bain, B. (2020). The essex boys.

von Hayek, F. A. (1988). *The Fatal Conceit: The Errors of Socialism*. University of Chicago Press.

Voznesenski, D. (2024). *War and Wheat: Navigating Markets During Global Conflict*. Power Writers Publishing Group.

Wilmar International Limited (2024). History and milestones. https://www.wilmar-international.com/about-us/history-milestones.

Wilson, W. W., Bullock, D. W., and Dubovoy, I. (2025). Dynamic changes in the structure and concentration of the international grain and oilseed trading industry. *Applied Economic Perspectives and Policy*, 47(4):1561–1582.

Yergin, D. (1991). *The Prize: The Epic Quest for Oil, Money, and Power*. Simon & Schuster.

Yergin, D. (2011). *The Quest: Energy, Security, and the Remaking of the Modern World*. Simon & Schuster.

Zannetos, Z. S. (1966). *The Theory of Oil Tanker Rates: An Economic Analysis of Tankership Operations*. PhD thesis, Massachusetts Institute of Technology.