

# Physical and Financial Agricultural Markets

*'You should buy land, they don't make it anymore.'*

Mark Twain

## 1.1 AGRICULTURE AND THE BEGINNING OF HUMAN SEDENTARIZATION

Commodities have been produced and exchanged throughout history and trade is an integral part of human civilization. In fact, one can argue that the rise of the latter has its origin in organized commodity production and distribution. As nomadic men settled on land to cultivate crops and graze their cattle, an agriculture-based economy came to existence, while some became carpenters, ironsmiths, goldsmiths, and shipbuilders. Goods were provided by the producers of diverse crops and livestock products in exchange for services. Farmers would bring their excess crops to a central location where they were carefully weighed – interestingly, the existence of weights can be traced back to several millennia before our era. The crops were then stored in a public building, which was the first form of a warehouse.

It was the emergence of barter and soon-emerged bazaars and markets that today still defines the centers of towns and villages. Trading merchants and artisans were organized into 'guilds' as early as the fourth century CE. From the first century CE, gold coins, wine, wheat, and linen were traveling east from the Roman Empire; ivory, silk, and precious stones were sent from India. As civilizations spread over the world, vessels started carrying goods, spices, and silks across the oceans. Indian literature from the beginning of our era mentions the existence in Southern India of separate markets for different commodities, such as grains, spices, cloth, and jewelry, located in particular in towns along the coast. Guilds and merchant groups were formed to represent the population.

The name of these merchant guilds in the northern part of Europe was the 'Hanseatic League,' which was part of Bruges in Belgium. Bruges was the main commercial city in the world during the 13th century, at the intersection of many trade roads, with wool coming from Scotland to feed the weaving industry in the city. In 1277, the first merchant fleet came to Bruges from the Italian port of Genoa, linking the city trade to the Mediterranean sea. This opened Bruges to the trade of spices and also to large capital flows brought by foreign merchants. The 'Bourse' opened in 1309 and is considered to be the first stock exchange in the world, showing that financial trading followed the trading of raw materials, and not the other way around. Even though Bruges fell behind Antwerp after 1500 as the economic capital of the region, Zeebrugge – the port of Bruges today – is an important location since the underwater natural gas interconnector from Bacton in the UK ends in Europe, and Zeebrugge is, at the time of writing, the main natural gas index in continental Western Europe.

Similarly, global trading and financial centers such as London, New York, Rotterdam, and Hong Kong owe their position in the present world economic map to their age-old trading culture. With the creation of the World Trade Organization (WTO) in the mid-1990s, commodity markets have experienced a new dramatic growth, both in physical goods and through derivatives platforms. Many types of different players came along to offer financial products infinitely more complex than the simple Futures contracts traded on the Chicago Board of Trade since 1848.

Looking back at the last two centuries, the world has witnessed a dramatic increase in wealth and prosperity in both the developed and developing countries. Poverty has reduced significantly not only in the developing countries of Asia and South America, but also in Africa. Shipping has continued to play its crucial role, while modern multi-purpose warehouses and elevators came to existence together with the advent of sophisticated commodity securitization. Looking back at the last 50 years, the boom of the 1970s in commodities was followed by 20 years of stagnant prices – in fact largely decreasing if adjusted for inflation for all commodities and agricultural ones in particular, with subsequent damage for the commodity-producing developing countries. The years 2001 to 2005 for energy and metals, and 2006 and 2007 for agricultural commodities, saw gigantic rises in all commodity prices. The financial crisis sent all prices down (except for gold) during the second half of 2008. Since 2009, commodity prices have rebounded but *volatility* became even more diverse across commodities.

The spectrum of *scarcity* is one of the key drivers of this volatility, in a world where the population could exceed 9 billion by 2050.

### 1.1.1 Some recent numbers

Between the beginning of 2014 and the political changes in Crimea, wheat prices went up by 27%. In an unrelated manner, coffee prices went up by 72% because of a severe drought in Brazil, cocoa by 8%, orange juice by 11%, sugar by 6%, and milk by 42% (because of a rising milk demand from Asian countries) – making breakfast quite expensive for the fortunate citizens of the world who can afford all or part of these items!

In the USA, meat prices have gone up as well, because of tight cattle supplies after years of drought in states such as Texas and California.

### 1.1.2 The growing role of Africa

Some economic experts compare Africa today to China 10 or 20 years ago. What is certain is the fact that Africa's GDP and exports are notably higher. More importantly, agricultural commodities represent an increasing fraction of these exports, which is great news since crude oil in Nigeria and some other African countries arguably represents the *resource curse*.

- Nestlé, which already owned 36 production units in Africa, opened three new ones in Angola, Mozambique, and Democratic Republic of Congo.
- Coca-Cola plans to inject \$12 billion in its African bottling sites by 2020.
- Between 2007 and 2011 Ghana doubled the quantity of cocoa processed in the country, bringing it to 25% of local production – a number still far from the 94% fraction of cocoa that is processed in Indonesia and exported in the semi-transformed form of cocoa butter, generating extra revenues and jobs for the country.

- In 2011, out of a total amount of \$581.8 billion of exports, coffee, tea, and cocoa represented \$15 billion; vegetables and fruit \$11.5 billion; and fertilizers in a raw or processed form \$80.3 billion.

## 1.2 THE OUTLOOK OF AGRICULTURAL COMMODITIES MARKETS

### 1.2.1 Recent mergers and acquisitions

- In 2010, Wilmar acquired the Australian sugar company Sucrogen.
- In 2010, a bid by BHP Billiton to acquire Potash Corp. for \$39 billion was stopped by the Canadian government.
- In 2011, Gaviion bought the US grain handler DeBruce Companies.
- Also in 2011, Cargill acquired the grain business part of the Australian company AWB for \$677 million.
- In 2012, Glencore acquired the Toronto-listed agriproducts company Viterra for \$6.1 billion.
- In 2012, the giant food company Sara Lee spun off its coffee and tea business and renamed itself Hillshire. In 2013, it bought Van's Natural Foods, which makes gluten-free products.
- In 2013, Marubeni from Japan purchased the agriculture business of the US firm Gaviion for \$2.7 billion.
- An attempt by Archer Daniel to buy Australia's giant Grain Corp. in 2013 was rejected by Australian regulators – in that deal, ADM was in particular trying to have direct access to China and emerging markets. ADM is keeping its existing stake in Grain Corp.
- In 2013, China's agrifood company Shuanghui bought Smithfields Foods, the huge US-based pork and meat company, for \$4.7 billion, plus \$2.4 billion in its debt buyout.
- Cofco (China National Cereals, Oil and Foodstuffs Corp.) bought in February 2014 a majority stake in the Dutch grains trader Nidera for \$1.3 billion and is in talks to possibly build a joint venture with Nobel Group from Singapore.
- In 2014, Wilmar invested \$200 million in a sugar joint venture with the Indian group Shree Renuka.
- In March 2014, JP Morgan was supposed to sell its physical commodities business (including a large inventory position) for \$3.5 billion to the Geneva-based trading house Mercuria. According to a UK consultancy group, commodity trading income for the bank had fallen from a peak of more than \$14 billion in 2008 to \$5.5 billion in 2012, while trading houses benefited from not facing the same rules on capital as banks.
- In March 2014, the sugar and cocoa trading house Sucres et Denrées (Sucden) said it was buying the commodity merchant Coffee America, mentioning its synergies with Sucden's cocoa business. Both companies are privately owned.
- At the time of writing, Cargill is awaiting an anti-trust approval to form a three-way joint venture in US flour milling with the agricultural companies CHS and ConAgra, in order to optimize silo and processing capacity.
- In 2014, the Chinese company Bright Food bought Tnuva, the leader of food production and distribution in Israel, for \$1.8 billion. In 2010, it had bought Synlait, the milk producer from New Zealand, and in 2012 had acquired 60% of Weetabix, the British cereals maker.
- In September 2014, Noble Group formed an agri-business joint venture named Noble Agri, with a 51% stake for Cofco and some minority co-investors such as Hopu Investment, a Chinese private equity firm, Temasek, IFC and Standard Chartered Private Equity.

### ***The 2014 merger activity in the food industry***

In May 2014, the American agrifood company Mondelez International merged its coffee activity with DEB, a deal which will allow coffee numbers two and three to control more than 16% of the world market and try to get closer to Nestlé, the number one. The merger between the two coffee giants is likely to be funded by at least \$10 billion in debt financing. Under the planned merger, Mondelez will give its coffee brands in exchange for \$5 billion in cash and a 49% stake in the new company, which will be called Jacobs Douwe Egberts and be based in the Netherlands. The loans will be partly used to refinance existing debt on the balance sheet of Master Blenders.

The debt package will be one of the largest leverage financial deals since the financial crisis. The new company will represent a coffee giant with annual sales of \$7 billion, which will challenge Nestlé, the market leader.

In July 2012, the famous American agrifood company Sara Lee, founded in Illinois in 1939, split into Hillshire Brands, which covers its North American operations and Master Blenders, in charge of the international bakery business. The latter is owned today by the investment group JAB Holdings, which bought it for about \$10 billion in 2013.

Mondelez, which is well known for its snack brands, e.g., Ritz crackers, was spun off from Kraft in 2012.

The merged company will include the world's second and third largest coffee groups, with brands such as Jacobs Carte Noire, Gevalia and Millicano, and have a large share of this profitable market in more than 20 countries.

It will also combine DEB Senseo capsules with the Mondelez Tassimo brand, putting them in a position to overtake Nestlé's Nespresso capsule coffee in a world coffee market of \$80 billion.

Besides DEB in 2013, JAB Holdings bought in 2012 the Caribou Coffee chain for \$340 million and the Peet's Coffee & Tea chain for \$1 billion, trying to invest in many ways in the high-margin coffee business.

After the transaction, Mondelez should generate 85% of its revenues from snacks, up from 75%.

The company Hillshire Brands (former Sara Lee, as stated above) bought in May 2014 Pinnacle Foods for \$6.6 billion including debt, adding Pinnacle's Duncan Hines cake mixes, Log Cabin syrups, and the famous Wishbone salad dressings to its meat-centered range of products, in a context of higher prices for beef and pork prices partly due to the drought that has thinned US herds. Under the terms of the deal announced on May 12, Pinnacle investors will receive \$18 in cash and half a Hillshire share for each Pinnacle share they own, representing an 18% premium to Pinnacle's May 11 closing price.

The private equity fund Blackstone had paid \$2.2 billion in 2007 for Pinnacle, which went into an initial public offering (IPO) in March 2013.

At the time of writing, the bidding war for Hillshire Brands between Tyson Foods, the US food maker, which offered \$8.55 billion, and Pilgrim's Pride, is still ongoing.

## **1.2.2 'Trading places': from the ABCD to the NOW**

Transporting billion of tonnes of commodities and raw materials across the world requires a gigantic and expensive infrastructure comprising trucks, merchandise trains, barges, vessels, silos, crushers, elevators in ports, and a large expertise in the risk management of commodity prices, shipping rates, bunker fuel costs, currencies, and shipping insurance.

Credit is managed by trade finance banks, which secure the transactions or provide credit letters or collateralized trades. A central risk platform in big trading houses has to aggregate all exposures and positions, both physical and financial.

To address the needs of the world population, in terms of increased quantity and quality of food, the trading houses are massively investing in elevators and harbor infrastructures on the American continent, in Asia, and in the Black Sea.

All the companies described below are aware of the value of physical stocks against which logistics, crushing, and production are optimized. Moreover, in their origination activities with farmers, they are aware very early on of any weather event, plant disease or unusual vessel queues in narrow harbors like Sydney – all key elements to monitor and trade the volatility of these indispensable commodities.

### ***Cargill***

Cargill was founded in 1865 by William Wallace as an Iowa grain elevator and has since expanded into 65 countries. The company is now the world's largest trader of agricultural commodities and has the biggest market share in sugar, corn, and wheat. It increased its size with the purchase in 1998 of its arch-rival Continental, the grain trading giant.

Its 500 vessels travel between the continents with their cargoes of wheat, cocoa, and peanuts. From its office in Geneva, Cargill manages the delivery of more than 30 million tonnes of cereals and oilseeds per year, and activities ranging from grain silos in Canada to chicken farms in China.

In 2003 Cargill built the fund Black River Asset Management, an independent company that manages today \$5.9 billion invested in commodities, farmland, and agribusiness across 13 offices in the world.

Cargill is 80% held by the descendants of the Wallace family, the rest by employees. Its profits amounted to \$2.3 billion in 2013 (down from a record of \$3.95 billion in 2008) for revenues of \$137 billion and 142,000 staff members in 67 countries.

### ***Archer Daniels Midland (ADM)***

ADM came into existence in 1902 when George Archer and John Daniels began a linseed crushing business. Today it owns 10.8% of Wilmar International and 80% of the grain trading house Alfred Toepfer. ADM owns 270 plants where thousands of tonnes of oilseeds, wheat, and cocoa are crushed every day. It is one of the largest producers of corn-based ethanol and biodiesel, and is a major corn trader. ADM is listed on the New York Stock Exchange and has offices in Rolle, between Geneva and Lausanne.

In 2013, it bid \$2.9 billion for the Australian GrainCorp, which it already owned at 20%. The deal has stirred concern among some politicians and growers. Australia's Foreign Investment decided at the end of November 2013 that the deal was not in Australia's national interest, given GrainCorp's ownership of 280 storage sites in Australia and seven of the 10 grain port terminals in New South Wales, Queensland, and Victoria.

ADM has a subsidiary called ADM Investor Services, which manages the risks of the company and offers investment and brokerage services to outside customers.

Its profits were \$2 billion in 2012 (down from a record number of 2.15 billion in 2007) for revenues of \$80.6 billion and 30,000 employees in 75 countries.

In 2013, the revenues of Arch Daniels were \$89 billion; its market capitalization is about \$26 billion.

### ***Louis Dreyfus Commodities (LDC)***

LDC came to existence in 1851, when Leopold Louis-Dreyfus, the 18-year-old son of a farmer from Alsace, first purchased wheat from local farmers and transported it for sale in Basel, eight miles away. More than 160 years later, the company has operations in the following global regions: North America; north Latin America, south Latin America; Europe and the Black Sea; Asia; and the Middle East and Africa. It covers most traded agricultural commodities such as grains, oilseeds, rice, cotton, coffee, fertilizers, and dairy. LDC specializes in ‘origination,’ an activity of developing customized, long-term transactions with market counterparties such as producers, large industrials, and storage companies.

LDC is the ‘D’ of what is known in the industry as the ABCD, with Archer Daniels, Bunge and Cargill, groups that dominate agricultural flows.

In 2011, LDC started Edesia Asset Management whose hedge fund, dedicated to agricultural commodities, collected \$2 billion.

In September 2012, Louis Dreyfus Commodities tapped the capital markets for the first time in its 160-year history, raising \$350 million in a perpetual bond, in order to develop its activities along the supply chain. The bond issue illustrates the new needs for funding created by high commodity prices, acquisition of new logistics and infrastructure, and European banks’ scale back of their lending activities. LDC said that the bond issue strengthened its balance sheet without diluting the existing family shareholders.

The bond pays a coupon of 8.25% and is listed on the Singapore Exchange. Buyers of the bonds, which were three times oversubscribed, were mostly Asian and Swiss investors. LDC has the option to buy back the bond after five years.

With net profits of \$735 million in 2011, LDC is probably the world’s largest trader of cotton and rice, as well as a leading trader in grains, sugar, coffee, and orange juice. LDC recently stated that they planned to spend \$5 billion over the next five years to keep up with the consolidation in global agribusiness.

The Louis-Dreyfus family owns 80% of the company and 500 employees own the rest.

The net profits amounted to \$1.1 billion in 2012, its best year, for revenues of \$57 billion and 20,000 employees in 75 countries. The revenues of LDC in 2013 were of the same order.

### ***Bunge***

Bunge was founded in Amsterdam in 1818 by Gottlieb Bunge, with the purpose of being an import/export grain company. In 1859, Gottlieb’s grandson Edouard relocated the company to Antwerp, where it became one of the world’s leading commodity traders; Edouard’s brother took the Bunge name to Argentina. In 1905, Bunge expanded into Brazil and entered food chain production with a wheat milling business. Bunge grew in the following 100 years together with Brazil’s agricultural economy.

In 1918, a century after its founding, Bunge began trading commodities in North America, the world’s largest agricultural market. In 1923, it acquired a Brazilian cottonseed processor and from that moment, balanced its growth between North and South America.

In 1935, Bunge built a major grain-handling facility in Minnesota and became a grain originator in the USA. In 1938, it entered the Brazilian fertilizer market and became both a supplier and customer to farmers. In 1945, Bunge dispatched its first shipment of Brazilian soybeans to become today the largest exporter of agricultural products from Brazil – and created a Brazilian company called Fertimport to manage raw materials shipments.

In 1961, Bunge opened an export grain-handling elevator in Louisiana in order to connect its US grain business to the world markets; it then built its first US soybean processing plant.



During the 1970s and 1980s, Bunge grew along the food production chain by building grain origination, soy processing, and food products businesses in North and South America. In 1979, it became the world's largest corn miller by acquiring the Lauhoff Grain Company. At the same time, it joined the US food aid program meant to combat hunger in the world.

In 1997, Bunge started a major expansion in South America by acquiring IAP, a Brazilian fertilizer manufacturer, and Ceval, the largest soy processor in Brazil. Other acquisitions made Bunge the largest fertilizer producer and soy processor in South America. In 1998 the company built a big soybean crushing and refining plant in the US.

Bunge went public in 2001 in an IPO listed on the New York Stock Exchange.

As of 2004, it moved into Eastern Europe by opening a new port in Turkey; purchased the first soybean refining plant in the port city of Rizhao in China; and acquired Petrobras' fertilizer operations in Argentina.

In the last few years, Bunge bought a number of sugarcane mills in Brazil where it operates a large sugar and bioenergy business producing sugar and ethanol.

Its net profits in 2012 were \$64 million, with revenues of \$61 billion and 36,000 employees in 40 countries.

### ***Noble Group***

Noble was founded by Richard Elman in Hong Kong in 1987, but the company quickly branched out beyond Asia. It acquired in the early 2000s assets and customers from the Lausanne-based trading house Andre & Cie, which was the fifth largest commodity house after ABCD but went under because of its high leverage and the non-monitored activities of a soybean trader. The company is viewed today as a mini-Glencore because it has diversified across energy, metals, and agricultural trading.

Listed in Singapore in 1997, the founder's family is the largest shareholder; China's sovereign wealth fund, China Investment Corporation, is the second.

Noble's net income was \$0.47 billion in 2012, with a record of \$0.60 billion in 2010. Its revenues in 2013 were \$98 billion.

### ***Wilmar***

Wilmar was founded in 1991 in Singapore by the Kuok family, which in 1949 had already started a trading business in Malaysia. It is the world's biggest producer of palm oil, farming palm and processing its oil. Palm oil is a key ingredient in processed food.

Wilmar has positioned itself as the leading trader and supplier of vegetable oil to China, covering a quarter of the market. It controls 60% of the retail market of vegetable oil in China.

It was listed in Singapore in 2006. ADM acquired a 17% stake, making it the largest shareholder after the Kuok family.

The company also moved into soybeans, on the assumption that China's middle class would raise demand for meat, hence soybean meal for cattle and pigs. The strategy paid off until an aggressive expansion of China's state-owned processors caused overcapacity in the sector.

Wilmar is now pushing into palm oil and edible oils in Africa where a greater spending power is finally emerging.

It is also diversifying into sugar, a commodity long dominated by Cargill, ED&F Man, Sucre & Denrées, and Louis Dreyfus. Wilmar acquired the Australian company Sucrogen in 2010.

In 2014, the company entered India, the world's second largest sugar producer, with a \$200 million investment in a joint venture with the Indian group Shree Renuka, which has 100,000 hectares of sugar cane in Brazil, itself the world's largest sugar exporter.

Sugar now accounts for 7% of the group profits, while oilseeds have halved from 26% in 2009 to 13% in 2013 and consumer-oriented plantations for 15%.

Palm oil refining continues to account for 48% of pre-tax profits, but Wilmar is now facing tough competition from refining capacity in Indonesia.

The group is expanding into higher-margin areas such as oleo chemicals and specialty fats.

Its pre-tax profits amounted to \$1.32 billion in 2013, with a record of \$1.88 billion in 2009; its market capitalization went down to \$17 billion in 2013.

With Noble and Olam, Wilmar constitutes the NOW, the Asian counterpart to ABCD. NOW is in search of the same profits with the same strategies as ABCD.

### ***Vitol***

Vitol was founded in 1966 in Rotterdam by two Dutch businessmen, Henk Victor and Jacques Detiger. It trades gas, coal, power, and emission credits, and has expanded into sugar and grains. The company has been profitable from the start and belongs to its 330 employees.

Its net income was \$1.05 billion in 2012, with a record year of \$2.28 billion in 2009.

### ***Glencore***

Glencore, the largest commodity trader specializing in metals and minerals and based in Zug, Switzerland, diversified into agriculturals trading by buying in 2012 the trading group Viterra, based in Canada, for C\$6 billion.

Glencore floated its shares in London in 2011. The total revenues of Glencore were \$240 billion in 2013 for the various types of commodities traded.

### ***Cofco (China National Cereals, Oil and Foodstuffs Corp.)***

China's food giant Cofco Corp. announced in February 2014 that it was buying a 51% stake in the Dutch grains trader Nidera. By doing so, China's largest state-owned grain trader will have a greater control of world prices as well as better access to major grain regions such as Latin America and Russia. The deal will also put China in direct competition with global agricultural trading houses such as the ABCD.

Cofco was targeting Nidera for its operations platform in Brazil, Argentina and Central America, and Europe as well as a very large global network of customers.

Cofco units include Mengniu Dairy Co., beverage and wine producer China Foods Ltd, and China Agri-Industries Ltd, which processes and trades commodities such as oilseeds and rice.

So far, Cofco had only been making small deals overseas, such as a \$136 million acquisition of the Australian sugar producer Tully Sugar in 2011.

Cofco currently trades about 20 million tonnes of grains annually – this can be compared to 55 million tonnes for Marubeni after it acquired Gavilon.

Cofco is in talks with Noble Group to establish a joint venture in sugar, soybeans, and wheat. It has the budget to assemble a formidable international presence. Cofco also wants to raise its processing capacity in corn grinding and oilseed crushing from 50 million tonnes in 2012 to 77 million tonnes in 2015.

Cofco revenues rose 13% last year to \$31.7 billion, but profits fell 20% to \$585 million, numbers that are comparable to \$136.7 billion and \$2.31 billion for Cargill.

### ***Nidera***

Nidera was founded in the 1920s and took its name from the countries where it was trading: Netherlands, the (East) Indies, Deutschland (Germany), England, Russia, and Argentina.



Nidera trades a variety of agricultural commodities, including grains and soybeans, and employs 3800 people in 20 countries

The total firm value of Nidera was estimated by experts to be \$4 billion at the time of the deal with Cofco (Merco Press, March 20, 2014).

### *Sucden*

The company was founded by the French businessman Maurice Varsano in 1952. It is private and headquartered in Paris.

A market leader in global sugar activities, Sucres & Denrées is involved in sugar sourcing, logistics, risk management, trading, processing, and distribution. The group originates and ships annually more than 8 million tonnes of sugar (bulk/bagged/container) while also selling over 1 million tonnes in domestic markets. Logistical and industrial activities have been developed in Russia, Brazil, Mexico, India, United States, and several African and Latin American destinations.

Over the years, Sucden has expanded into products such as cocoa, ethanol, ocean freight, coffee, as well as Futures and options trading on major exchanges.

It has 4000 staff across 30 locations worldwide. The revenues in 2013 were \$5.5 billion, the profits \$83 million.

### *US food companies' dollar revenues in 2013*

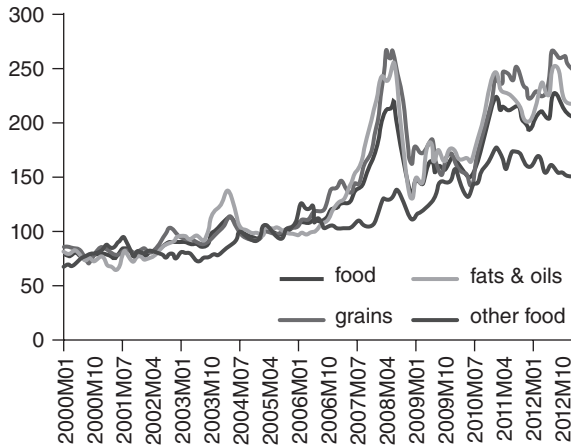
Krafts	18.2 billion
General Mills	18.1 billion
ConAgra	17.4 billion
Kellogg	14.8 billion
Campbell	8.4 billion
Hillshire/Pinnacle Foods	4 + 2.6 billion
McCorming	4.1 billion

## **1.2.3 The physical markets**

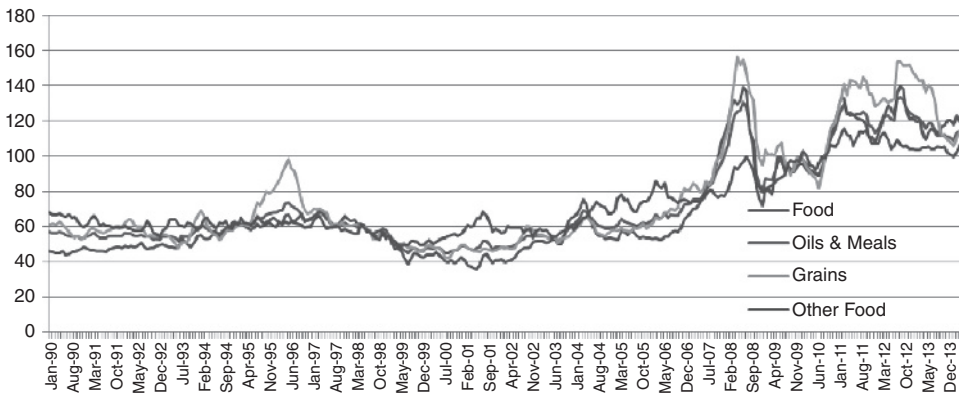
Markets take place mainly in three forms:

1. Small regional markets with limited storage capacity that are only able to serve small areas; the commodity changes hands immediately after the transaction is concluded.
2. Auction markets that bring together many players in a centralized and open platform where they interact through ex-ante transparent prices – as happens in the world of art.
3. The warehouses of exchanges where the physical commodity is delivered to the buyer of a Futures contract who did not close his/her position prior to maturity.

In June 2013, the World Bank's Food Price Index remained 12% below the recent all-time peak of August 2012, but was only 2% lower than in June 2012. The picture was different across subclasses: the food index was down 2%, grains up 5%, fats and oils down 4%, fertilizers down 15%. Among the grains, corn/maize was up 12% over the year June 2012–June 2013, rice was down 10% (5% for the Thai price), wheat up by 13%, sugar down by 16%, soybean oil by 12%.



**Figure 1.1**  
 Source: World Bank DECPG. The World Bank Global Food Price Index weighs spot prices in nominal US dollars of a variety of food commodities around the world; base 100 in 2005 in the above chart



**Figure 1.2**  
 Source: World Bank

Current wheat prices reflect expectations that world production will rebound in the agricultural year 2013–2014 (*Food Price Watch*, July 2013). Good harvests are expected from major producers – with the exception of the USA – such as Europe, the Black Sea, Australia, and China. China’s wheat is benefiting from higher subsidized inputs such as seeds, fertilizers, and fuel.

Corn production is expected to reach a record high in the new agricultural year, with substantial increases expected in China, Brazil, Argentina, Europe, and the USA. (See Figures 1.1 and 1.2.)

### 1.2.4 The global flows of commodities

According to the German grain trader Toepfer International, about 300 million tonnes of grains are traded globally each year, about 15% of the total world production.

In 2011–2012, the commodity flows were as follows:

- Europe imported 35 million tonnes of soybeans, exported 41 million tonnes of wheat and 15 million tonnes of corn.
- Africa imported 40 million tonnes of wheat, 13 million tonnes of corn and 7 million tonnes of soybeans.
- North America exported 48 million tonnes of soybeans, 43 million tonnes of wheat and 38 million tonnes of corn
- South America exported 85 million tonnes of soybeans, 4 million tonnes of corn and imported 9 million tonnes of wheat.
- Asia imported 89 million tonnes of soybeans, 39 million tonnes of corn and 10 million tonnes of wheat.
- The US Department of Agriculture foresees that world trade in coarse grains used to feed livestock will rise 25% to 179 million tonnes in the next decade.
- The Food and Agriculture Association (FAO) forecasted a wheat production at 704 million tonnes and a world total cereal production of 2515 million tonnes, resulting in an increase of 572 million tonnes by the end of the 2014 crop season, and a stock-to-use ratio approaching 24%, the highest since 2002–2003.

In May 2014, the WTO raised its forecast for growth in global trade to 4.7% for 2014, up from a previous estimate of 4.5% but still below the 5.3% 20-year average, a number that the WTO estimates for 2015.

Over the years 2012 and 2013, growth averaged only 2.2%, a number remarkably lower.

The WTO sees improved prospects for the USA and Europe, but highlights geopolitical risks as threats to global recovery, because of territorial disputes in the Middle East, Asia, and Eastern Europe that could disrupt trade flows if they escalate.

In 2013, the European Union became the first exporter of agricultural products, with 120.1 billion euros of exports and an increase of 5.3% (it was 12% in 2012 versus 2011), ahead of the USA which generated 115 billion euros, down by 1.7% compared to 2012.

### **1.2.5 Back to the future: a new age for barter**

- In October 2012, Ukraine signed a loan-for-crops contract with the Export-Import Bank of China, according to which Kiev got \$3 billion in credit lines.
- In exchange, China will get 3 million tonnes of corn every year, to be supplied at the-then market price.
- According to estimates of the US Department of Agriculture (USDA), China will have bought overseas about 8.3 million tonnes of corn between 2011 and 2013, as much as it imported over the previous 15 years combined.
- Under Beijing's policy of 'self-sufficiency,' corn imports alone will grow almost half to 152 million tonnes.
- In the past, China used to buy corn from the USA and Brazil through international trading houses such as Cargill and Louis Dreyfus.
- China became the world's fifth largest importer of corn, importing in 2012 5.3 million tonnes of corn, versus 100,000 tonnes from 1997 to 2009. Corn is a key feed-meal to fatten cows, sheep, and pigs as consumption of meat in China continues to grow.
- The Ukraine/China deal is likely to raise concerns among other big importers of agricultural commodities in Asia, like Japan and South Korea.

- Ukraine said the Chinese loans would be used for the purchase of Chinese agricultural technologies, herbicides, and pesticides.
- It is worth noting that Beijing has used its financial power over the period 2007 to 2012 to secure supplies of commodities (particularly crude oil), offering Russia, Brazil, Ecuador, and others multi-billion dollar loans repaid with raw materials rather than money.
- Venezuela doubled in May 2012 its line of credit with China, reaching a debt of \$32 billion. It has been shipping 100,000 barrels a day of crude oil, or 5% of its production, to repay a \$4 billion loan from the China Development Bank.

### 1.2.6 The sources of information in agricultural commodity markets

- International agencies and NGOs
- Food and Agriculture Association of the United Nations
- World Food Program of the UN
- UN Commission on Trade and Development (UNCTAD)
- International Fund for Agricultural Development
- World Trade Organization
- World Bank: World Bank Observer, World Bank Economic Review
- International Monetary Fund
- OECD
- US Department of Agriculture
- Business publications such as *Fertilizer Week*, CRU publications.

On the industry side, a number of websites are available: American Farmers Bureau; US Grains Council; Grain Growers of Canada; US Meat Export Association.

## 1.3 HISTORY OF COMMODITY FUTURES AND SPOT MARKETS

### 1.3.1 The actors in financial markets

We need to keep in mind that in any market, be it stocks, bonds, currencies or commodities, there are at all times four types of players:

- *Hedgers*, who buy or sell Futures contracts in order to eliminate the uncertainty brought to their revenues by the random evolution of the prices of one or several assets that are central in their economic activity. On the exchange, these actors declare themselves as ‘commercials.’ For instance, a farmer would sell corn Futures contracts in January in order to eliminate from that moment the randomness in the selling price of his crops harvested in September. An agrifood company that has a production cycle of processed coffee in four months would buy coffee Futures today.
- *Arbitragers*, whose activity is solely to observe the prices and identify anomalies between prices of Futures of different maturities or between a Futures contract and the underlying commodity prices. The existence of these arbitragers ensures that anomalies do not last very long and makes the assumption of ‘No arbitrage’ discussed in Chapters 3 and 4 roughly legitimate. We can note that, obviously, these arbitragers are not numerous since this activity requires a large confidence in one’s ability to know the ‘fair price’ of an asset at all times.

- *Speculators* are all the other market participants, those who did not have a hedging need or identified a price anomaly. Consequently, they take risk in their trading activity in order to make profits. According to this definition, we certainly recognize the existence of speculation in commodity Futures and spot markets, as the hedgers need counterparties to build the long and short positions that will lock the selling (or buying) price of a commodity ahead of time. Hence, we will state, as did many famous economists over time, that speculators are *liquidity providers*.
- *Market makers* act on behalf of both hedgers and speculators and facilitate their trading activities in the exchange of fixed commissions.

Given the sensitivity of issues related to food, agricultural commodities trading has regularly been accused of being responsible for high prices and/or high price volatility, sometimes by governments facing a difficult situation in the country. The charges are particularly leveled against financial players and Futures markets. It is important, however, to keep in mind some numbers: in August 2013, the dollar value of the total open interest in all agricultural commodity Futures was about 9.6% of one year's worth of global production (because of the gigantic number of small farms around the world feeding the local population) and 3% of a single year's transactions in all physical markets.

### 1.3.2 The actors in agricultural commodity exchanges

We will follow Dana (The World Bank Report, 2008) to recognize four categories of actors on these exchanges:

#### 1. Producers, consumers, and processors

Most producers, consumers, and processors trade on the exchange through trading houses and brokerage firms.

They use the exchange instruments for the purpose of hedging commodity price risk, which is a major component of their physical trading. Consumers and processors are more active than producers because market access is not always available for producers who are often located in developing countries.

#### 2. Trading companies

A number of international, multi-commodity houses such as Bunge, Archer Daniels, Dreyfus, and others use the exchange to manage the physical and financial exposure of their trading activities in grains and soft commodities around the world.

#### 3. Brokerage houses

These are financial institutions, also called commissioned houses, that act as market intermediaries and make profits based on fixed commissions. Most brokerage houses are active on more than one exchange and hold relationships with market participants such as producers, consumers, processors, funds, and investors. International banks with commodity lending portfolios and credit finance activities may also have a commodity brokerage division designed to mitigate the risk of lending and earn profits from market-making activities.

#### 4. Managed funds and institutional investors

Pension and university endowment funds (e.g., Harvard and Yale) and insurance companies have been investing in commodities for a long time as a way to mitigate inflation risk. Since the beginning of the 2000s, a massive number of financial players such as hedge funds have been attracted to commodities by the combined properties of diversification and the large returns that did not prevail in the 1990s.

### 1.3.3 The growth of Futures markets exchanges and the recent mergers

#### *Governance rules*

Futures markets are an essential element of risk management in physical markets. They must provide an infrastructure ensuring a market clearing price at all times. Warehousing and delivery systems linked to Futures exchanges also represent an important element of efficient price formation, which helps the convergence of Futures to spot (physical) prices. While industrial metals warehouses are needed close to consumption areas, agricultural commodities require a location next to production areas since they must immediately go to proper storage, and shortly after to delivery. The exchange must enforce trusted procedures to assess product quality and enforce effective supervision of the delivery process such as minimum *loading-out rates* by the warehouses, a necessary condition for the convergence of spot and Futures markets at maturity, generated by the commitment to deliver attached to a Futures contract and the reason for the *price discovery* benefit of Futures markets.

The difference between the spot and Futures price around the last trading dates is called the *premium* and is due to the costs of delivery and storage created by supply bottlenecks and delivery queues. This premium is paid by the buyer of the Futures contract. It was an average of 10% in the Chicago Board of Trade (CBOT) corn Futures contract in 2011 and this number should be an upper bound for Futures markets to keep their fundamental ‘raison d’être.’

The necessary *infrastructure* has to be organized by the exchange near the production areas in the case of agricultural commodities (in contrast to consumption places for metals); the mandated warehouses regularly monitored and the delivery rules clearly specified. Until recently, the delivery rules of the London Metal Exchange left open a large window for delivery and the exchange was itself getting part of the storage fees charged by the warehouses to the buyers of Futures contracts.

#### *Some history*

The Chicago Board of Trade came to existence in 1848, was relocated in 1885 in a skyscraper building now listed as a National Historic Landmark, and features in its atrium a three-story art deco statue of Ceres, holding a sheaf of wheat in her left hand and a bag of corn in her right hand (Ceres was the Roman goddess of agriculture, grains, crops, and fertility). With this statue, the exchange wanted to make sure that members on the trading floor would keep Ceres in mind as well as the integrity crucial to the continuation of Futures markets.

In 2007, the CBOT merged with its rival the Chicago Mercantile Exchange; in 2008, the NYMEX merged into the combined CME Group.

At the beginning of 2013, the Hong Kong Futures Exchange bought the London Metal Exchange for \$2 billion. ICE (Intercontinental Exchange), an ambitious trading center based in Atlanta, USA, with a primary specialty in energy and commodity contracts and an existence of less than 15 years, had acquired in December 2012 NYSE Euronext for \$8.2 billion; it bought in November 2013 the Singapore Mercantile Exchange for \$150 million, securing for itself an introduction in a part of the world that is becoming the main battlefield for derivatives trading. SMX is a small commodity exchange launched in 2010 with \$75 million in capital from Financial Technologies, which also owns India’s MCX commodities exchange. It offers Futures markets for metals, currencies, energy, and agricultural commodities but has suffered from low volumes since the start.



The move puts ICE ahead of rivals CME Group and Deutsche Börse to capture business in Asia, where China's needs for raw materials are creating greater use of hedging strategies. It allows ICE to position itself with respect to its rivals in the region – including the Singapore Exchange (SGX) whose derivatives are the fastest growing activity – and become the first non-Asian exchange to own a clearing house in the region, hence offer clearing in Asia directly as opposed to having energy and commodity derivatives cleared in London. SGX reacted positively to the news and observed that the deal pushed Singapore as the pre-eminent Asian place for commodities trading.

According to the Futures Industry Association, Asia accounted in 2013 for 15 to 20% of global exchange-traded derivatives volume, with the rest roughly equally split between North America and Europe. Deutsche Börse and CME Group are also considering building derivatives clearing houses in Asia.

### *The security of the margining system*

The proper amount of initial margin and maintenance margin that an exchange must request from market participants placing orders is crucial since this deposit will be the intermediary collateral before the margin call is paid after a large market move.

The system that is used by most exchanges, including the CME, the Shanghai Exchange, and the Singapore Exchange, is called SPAN (Standard Portfolio Analysis). Indeed, the exchange holds a gigantic portfolio of short and long positions since it is at all times the counterparty for buyers and sellers. The SPAN rules, which have existed for more than 30 years, were from the start quite conservative and there has been no problem so far (see Carr, Geman, Madan and Yor, 1999).

Our view is that the initial and maintenance margins per contract should increase (see Carr *et al.*, 2001) with the size of the position when it goes above a level defined specifically for each commodity from the careful analysis of numbers of trading volume and open interest over a long period (e.g., 20 years), as well as scenarios chosen outside the familiar models.

## **1.3.4 Futures markets and price volatility**

Among the first papers on the subject, Boyle (1922) argues, on the basis of more than 100,000 pieces of data, that the establishment of the CBOT Futures market was responsible for the corn price volatility decrease between 1841 and 1921. Looking at Europe, the Berlin Produce Exchange was a very influential food market on the continent until grain consumers in the German Reich suffered an increase in both level and volatility of prices after a disastrous harvest took place in 1891 in Germany and Russia. This resulted in a public agitation against speculative activity on the Bourse and an Imperial Commission was established to investigate the efforts of stock exchanges. From January 1, 1897, the Berlin Produce Exchange was forced to incorporate representatives of agricultural and milling interests in its executive committees. The publication of Futures and spot prices was prohibited – a major mistake as price transparency is the most desirable property regulators could wish for at all times – and trading grains was banned. Berlin went to the status of a small provincial market. At the same time, wheat prices and price volatility spiked... In April 1900, the Berlin Futures market was reopened.

Returning to the USA, the Onions Futures Act in the fall of 1958 marked the only time in the history of the country that Futures trading in a commodity was banned. It is well known that it is essentially impossible to store onion crops from one year to the next, hence an increase in price volatility at the approach of harvest is expected – in full agreement with the intuition and the Theory of Storage discussed in Chapter 2. The ban of the onion Futures

triggered a spike in spot price volatility in the following six months, and higher price volatility in the following five years. No exchange trades onions today since this commodity is usually consumed where it is produced.

All these points are discussed in the paper by Jacks (2007), who investigates the relationship between Futures markets, speculation, and commodity price volatility. The fundamental result the author exhibits is that, in fact, Futures markets are systematically associated with lower levels of commodity price volatility.

Geman (2011) argues that scarcity in the spot commodity markets is not only the key driver of the spot price volatility, but is also an important factor to explain the shape of the forward curve. She notes that the very high prices of food commodities observed in the recent years were triggered by weather events in the major producing countries for wheat and corn and suggests that regulators should primarily be worried by the systemic risk created by the ownership of large amounts of the underlying physical commodity by major financial players.

At the time of writing, the bank JP Morgan was about to sell to the Swiss hedge fund Mercuria, for roughly \$2 billion, its large physical commodities business built from the addition of the Bear Sterns commodity unit in 2008, parts of UBS Commodities in 2009, and assets from RBS Sempra Commodities in 2010 for a cost of more than \$2 billion – which allowed the commodities revenues of the bank to double between 2006 and 2009. Using special exemptions granted by the Federal Reserve and approved by the US Congress, a number of banks had bought after 2009 large amounts of infrastructure to store commodities and deliver them to consumers – from pipelines and refineries in Oklahoma and Texas; to fleets of double-hulled tankers at sea around the globe; to companies controlling operations at major ports like Oakland and Seattle. JP Morgan acquired Henry Bath & Son Ltd, a network of metals warehouses. In 2010, Goldman Sachs bought Metro International Trade Services, a company that owns 27 industrial aluminum warehouses in the Detroit area.

### **1.3.5 The role of indexes in the creation of efficient commodity spot markets**

The existence of large players in agricultural commodities and shipping renders the risk of spot prices manipulation significant. In the Futures markets, this is not feasible, in principle, since Futures prices are posted at all times by the exchange – hence, the benefits of liquid and transparent indexes, preferably quoted by a third party not involved in trading activities, such as either a statistical company that accumulates data or an entity like the World Bank, which publishes for instance the World Fertilizer Index.

Benchmark-based pricing mechanisms, which apply a discount or premium to a liquid reference price, rely on the liquidity of a reference contract, which is typically the front-month Future contract.

Liquid indexes reduce ‘moral hazard’:

- They allow the elimination of opacity.
- They are neutral to all parties.
- They make difficult manipulations of the spot price.
- Hence, they represent a necessary condition of the existence and development of liquid derivative instruments since they will be the reference price in the numerous cases of financial settlement.

### 1.3.6 Commodities and numéraire

Most commodities are still today denominated in US dollars; exceptions do exist – for instance, salmon contracts traded in Oslo are expressed in euros and Norwegian kroner. Hence, hedging against commodity prices involves also hedging the dollar component versus one's domestic currency.

After the catastrophic 16% fall of the Argentinian peso in 2013, soybean growers have been packing their dollar-denominated crops instead of sending them to the markets and getting pesos with little value. By the end of January 2014, only 6% of their most recent crop was sent to crushing plants and exporters, according to Macquarie's experts. The number was much lower than the 11% at the same time in 2013 and 25% in 2012. With Argentina's inflation rate of nearly 30%, USDA does not expect farmers to liquidate soybean piles as these are viewed as a protection against further devaluation of the Argentinian peso. In a parallel manner, USDA estimates that soybean inventories will reach a record 9 million tonnes this year, almost twice as much as the year before. Argentina accounts for about one-tenth of the world's soybean exports and almost half of soy meal trade.

In peso terms, soybean prices went up 20% during the first six weeks of 2014, compared to 1.6% for the CBOT soybean Futures.

It is one of the many examples where the tangible commodity has more value than the local currency.

## 1.4 SHIPPING AND FREIGHT

Ships and vessels have developed alongside humankind evolution. The first cargoes were transported by sea more than 5000 years ago. Moving silks and other precious merchandise across the oceans was already quite active in the 15th century, as evidenced in Shakespeare's *Merchant of Venice*. And the shipping of gold bullion to Wellington's army in Spain and Portugal was decisive in ensuring his victory. Today, freight has become an integral part of modern trade, with the transport of commodities by sea becoming cheaper and more reliable over time. For instance, the costs of shipping dry bulk like grains or iron ore have increased by only 70% (in nominal terms) over the last 50 years, a very small number compared to other industrial services and inflation numbers. This is due in particular to important technological innovations that occurred in the maritime sector and made it possible to move commodities across the world at a very competitive price.

Shipping markets are recognized today as a key component of the commodity asset class, playing a role in final prices of energy, agriculturals, and metals. The last 14 years have been the stage of major transformations for commodity markets, with the remarkable growth of the BRICs, government interventions in commodity-producing countries such as Canada, Australia, and China, and the necessity to feed the growing world population to cite the most visible explanations. For those who own vessels readily available for various destinations, 'locational arbitrage' may be achieved when the locational spread is greater than the cost of shipping. As for the originators and merchant houses who sell the commodity under a CIF (Cost of Insurance and Freight) label, transportation is such an important component of the revenues/profits that a whole department of the firm is dedicated to the shipping activity and its risk-management.

### 1.4.1 International trade

The first sea trade network that can be traced was developed 5000 years ago between Mesopotamia, Bahrain, and western India. The Mesopotamians exchanged their oil and dates for copper and ivory (see Stopford (2009)). The maritime code developed by the Mesopotamians was remarkably similar to the one prevailing today: ships were hired at a fixed tariff, proportional to the capacity of the vessel, and freight costs were paid in advance. The so-called Baltic Exchange was established as early as the mid-18th century, prior to the Chicago Board of Trade (1848) or London Metal Exchange (1877). It was primitively known as the Virginia and Baltic Coffeehouse, located in London's financial district, and was registered as a limited liability company with shares in 1900 (see Barty-King (1994) for an interesting history of the Baltic Exchange). Today, the exchange is owned by its members and operated by a board of directors. It is the world's single independent source of maritime information.

The year 1985 saw the creation of the Baltic Freight Index (BFI) as a benchmark for the world freight market, against which derivatives contracts would be financially settled. The original BFI was defined as a weighted average of spot rates covering 13 voyage routes related to a variety of dry-bulk vessels with cargoes ranging from 14,000 to 120,000 metric tonnes. Each major route incorporated in the BFI referred to a vessel size, a certain cargo, and a route description. The weights were assigned according to the importance of the route in the dry-bulk sector. For instance, the routes from the US Gulf of Mexico to Rotterdam and Japan were the most important ones, followed by the US Pacific Coast to south Japan.

The Baltic Capesize Index (BCI) is calculated on the shipping costs observed on 10 available routes for a Capesize dry bulk carrier. Each route is weighted according to its importance relative to the nine others. The Baltic Panamax Index (BPI) is computed on the four available routes for a Panamax dry bulk carrier, each route having the same weight (25%). Supramax vessels have six trip charter routes and three voyage charter routes but the Baltic Supramax Index (BSI) is only based on the six trip charter routes: two routes ( $S_2$  and  $S_3$ ) each account for 25% of the index and the other four each have a weight of 12.5%. Lastly, the Baltic Handysize Index consists of six routes, out of which two ( $HS_2$  and  $HS_3$ ) have each a weight of 25% and the four others 12.5%.

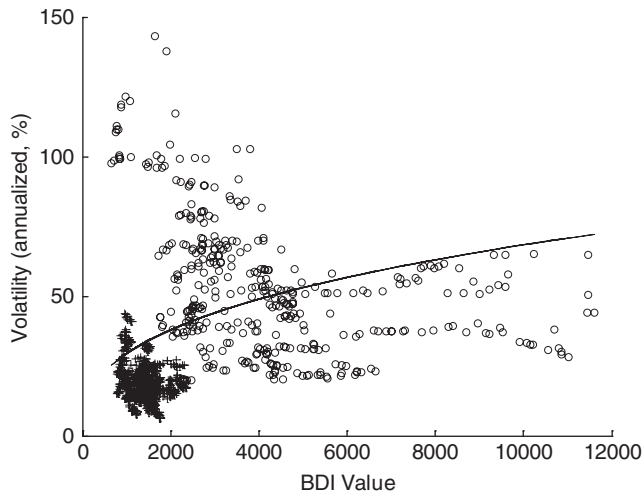
The Baltic Dry Index (BDI), the flagship today for dry bulk shipping costs, is computed as an arithmetic average of the Baltic Capesize, Panamax, Supramax, and Handysize indexes. Over the years 2009 and 2010, the conversion factor of the BDI rate into dollars has been 1/0.113473601; hence, on a day when the BDI value was 2269, for instance, the average charter price was \$12,672/day (to be adjusted to the size and voyage of a specific vessel).

We will mostly focus on dry bulk vessels and won't discuss the fascinating topics of oil or LNG tankers. However, we can note that in case of excess supply in the oil tanker market, oil tankers can be cleaned, dried, and used to transport cereals.

The expansion of international trade has been facilitated by large agreements within the WTO, the development of trade finance with new countries, the gigantic input of countries like Brazil and China, the explosion of cross-border trade across the world, and the deployment of a global world of activities of commodity producers and merchants.

### 1.4.2 Price formation in freight markets

The major types of dry bulk vessels are the categories of Capesize, Panamax, and Handymax, themselves defining indexes attached to each category; Supramax vessels are smaller in number at this point, but increasing for bunker costs efficiency as the harbors and canals become



**Figure 1.3**

wider and deeper. It was said before that in order to represent the market as a whole, the Baltic Dry Index (BDI) is defined as the arithmetic average of these indexes; in all cases, the price of bunker fuels accounts for roughly 20% of the shipping rate.

The major actors in the spot and forward freight markets are the large shipping companies, and unsurprisingly old commodity houses like Cargill or Louis Dreyfus and banks such as Rabobank or Morgan Stanley, which have been involved in the trading of commodities for a long time.

The importance of Asia in shipping and international trade is illustrated by the ‘Shipping Times’ pages (Figure 1.4) of the Singaporean newspaper *The Business Times* where a large number of voyages, vessels, and cargo services are proposed, illustrating the existence of a shipping spot market in such shipping hubs as Singapore, London or Baltimore.

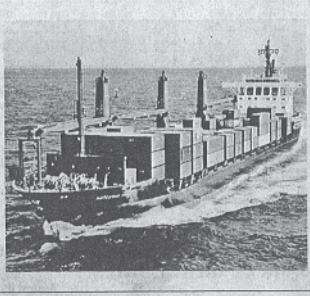
The supply of cargo ships is generally both tight and inelastic – it takes two to three years to build a new ship, and ships are too expensive to take out of circulation the way airlines park unneeded jets in the Arizona desert.

Hence, marginal increases in demand can push the index high quickly, and marginal demand decreases can cause a rapid drop in the index, as displayed in the price trajectories and volatility.

It should be noted at this point that grains and other agricultural commodities are not the only components of dry bulk activity. Metals and coal represent the other ones, although larger in terms of weight. Hence, it is useful to follow the dry bulk market as a whole when importing or exporting agricultural commodities. Looking at the BDI trajectory, very low prices are observed in the period starting mid-2010: this corresponds to the moment when a large fleet of new vessels that China decided to build to transport imports of coal, copper, and grains came to completion, creating a large increase in supply at a time when the growth of the world economy was slowing down. A decade ago, some analysts used to propose alternatively the BDI or copper prices as early indicators of the world economic health; the excess supply presently prevailing in the dry bulk market surely takes away any predictive power in its current value.

For an extensive description of the shipping markets, the reader is referred to the book by Alizadeh and Nomikos (2009); a tentative modeling of the BDI trajectory for trading or hedging purposes can be found in the paper by Geman and Smith (2012).





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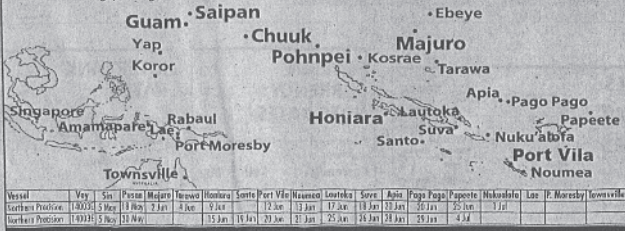
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Figure 1.4 Shipping offers in The Business Times of Singapore

The inelasticity of supply to demand makes the BDI behavior and volatility similar to those of electricity, the sole commodity that is not yet economically storable (except for hydro). We observe similar – though not identical – spikes. A simple mean reverting model is not quite appropriate either; nor is a so-called jump mean – reverting diffusion, as the force of mean reversion necessary to bring prices down from high peaks makes small ordinary moves quasi impossible. The jump-reversion model of Geman and Roncoroni (2006) for electricity can do a reasonable job to fit the BDI over the period 2002 to 2013.

As stated above, copper prices on the one hand and the BDI on the other were proposed by experts as early indicators of the world economy. In the graph in Figure 1.7, we can see that the two trajectories moved in the same direction during the years 2003 to 2010 (which include the financial crisis). They strongly decoupled as of 2010, which was the moment when a large number of vessels built in China came on line, following the Chinese decision not to rely on anyone to import into the country the commodities it needed. As usual, the force of supply and demand comes first in any commodity market.





**Figure 1.5** Baltic Capesize Index 2001 to 2013

### ***Forward freight agreements***

At the moment, the only liquid derivatives traded on freight rates are Forward Freight Agreements (FFAs).

An FFA is a contract where the long position secures the cost of freight for a specific cargo route over a defined future period.

It is based on a defined voyage or time charter or a specific index and is financially settled, like a forward rate agreement. The only difference is the fact that the underlying here is a freight index, instead of an interest rate index.

Since the settlement is based on a *shipping market index*, this one is very important and has to be assessed by an independent entity, as discussed earlier in this chapter. In practice, it is provided by the Baltic Exchange or the information provider Platt's, and is typically defined as the average of the last seven days in the expiration month or the monthly average, again to avoid manipulation or any undesirable phenomenon that may take place in the freight market on an isolated day.

In order for the indexes to be reliable, unbiased, and accurate reflections of the global spot market, the Baltic Exchange appoints panel companies that are assigned the task of reporting freight rates to the exchange on a daily basis. These panelists have to be members of the exchange, and represent broking firms (rather than shipowners or charterers) that are able to



**Figure 1.6** The BDI Index over the period 2000 to 2013

estimate how much it cost to move various cargoes of raw materials on various routes: for instance, 100,000 tonnes of iron ore from San Francisco to Hong Kong or 1 million tonnes of rice from Bangkok to Tokyo. Once the panelists have submitted their figures, the London-based Baltic Exchange is responsible for calculating the final index figures, which are published at 1 pm for the dry cargo. The BDI and the other major freight rates can be accessed from the Baltic Exchange or major news services such as Thomson-Reuters or Bloomberg.

Since the index on which a transaction of goods is concluded may be CIF (cost of insurance and freight paid by the seller) or FOB (this cost is paid by the buyer), one can lock in arbitrage opportunities ahead of time if it happens that the implied forward freight contained in the forward prices of the CIF and FOB indexes be different from the value of the FFA related to the same period and points of observation. The CIF and FOB prices of coal between Rotterdam and Richards Bay are widely scrutinized; in agricultural commodities, some residual inefficiencies may be identified and a successful arbitrage implemented.

### **Trading activity**

Baltic Exchange (London) used to offer Futures contracts, but now only offers forwards. Imarrex (Oslo) provides daily quotes on maritime shipping. LCH-Clearnet (London) is a central place for spot and forward trades in shipping.



**Figure 1.7** The BDI and copper price trajectory decoupling as of the end of 2010

New York, Baltimore, Singapore, and Hong Kong are other major centers of shipping trading.

The daily values quoted as the Baltic Forward Agreements (BFAs) are estimated mid-prices of bids and offers for the dry (and wet) market based on submission from brokers at 5.30 pm London time for the dry routes BFA Capesize, BFA Panamax, BFA Supramax, and BFA Handysize. Futures on the BDI were introduced, and then discontinued, by the International Maritime Exchange (IMAREX) in Norway, an exchange dedicated to shipping derivatives. IMAREX relies on the Baltic Exchange to provide it with independent assessments in order to clear its transactions. The settlement prices of FFAs are produced on the last working day of the month and computed as an average over a seven- or 10-day period of daily values. Moreover, the volume and open interest related to FFAs written on the BDI (and other dry indexes) are published on a weekly basis.

The expansion of commodity markets during the 2000s and the double-digit growth of the developing countries and BRICs have contributed to an amazing boom in maritime transport and shipbuilding. All records were shattered in the dry bulk market, with an unprecedented interest in bulk carriers. Moreover, the concomitant rise in bunker prices persuaded operators to reduce speeds, which in turn required the addition of more vessels to maintain the schedules. Interestingly, the congestion of major harbors plays such a key role in the supply/demand balance for shipping that options written on congestion indexes have been traded for a number

of years among the major actors; most send ‘spies’ to watch round the clock the length of the queue of vessels in Sydney Harbor or at the Suez Canal gates.

The sporadic building of strategic commodity inventories by some countries or large firms should be added to the list of unobservable sources for vessel demand changes. The supply of cargo ships, on the other hand, is inelastic under market conditions that can only be changed in the short term by changing vessel speeds, a costly solution in terms of bunker fuels. In the longer term, more permanent changes can take place by building new ships and/or scrapping older ones. Currently, it takes one to three years to build and deliver new ships, influencing essentially the longer-term supply for freight services.

The volume of international seaborne trade has vastly increased in the years 1975 to 2005 (see Alizadeh and Nomikos (2009)) and it continues to grow with the world population’s food needs.

Shipping rates exhibit large swings and volatility related to the cycles in the world economy, commodities consumption, and transport. Moreover, bunker prices are quite volatile since they are related to crude oil prices. Lastly, other risks influencing prices include fluctuations in scrap vessel prices, piracy, accidents, weather patterns (which create increased demand for energy-producing fossil fuels) as well as the bottleneck problems in some ports mentioned earlier.

Lastly, let’s mention that shipping was crucial in the development of the Silk Road; over 4,000 miles for the trade of Chinese silk as of 206BC. Besides its economic role, the Silk Road permitted the growth of cultural trade among the various civilizations on the way – China, India, Persia, Europe and Arabia in particular (see Shah and Rath, 2009).