The Financialization of Commodity Markets: A Short-lived Phenomenon?
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Editor:
Yves Jégourel
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List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>bbl</td>
<td>barrel of oil</td>
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<tr>
<td>CAP</td>
<td>Common Agricultural Policy</td>
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<td>CBOT</td>
<td>Chicago Board of Trades</td>
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<td>CCC</td>
<td>Commodity Credit Corporation</td>
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<td>CFTC</td>
<td>Commodity Futures Trading Commission</td>
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<td>CFR</td>
<td>Cost and Freight</td>
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<td>CIT</td>
<td>Commodity Index Trader</td>
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<td>CME</td>
<td>Chicago Mercantile Exchange</td>
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<td>COT</td>
<td>Commitment of Traders</td>
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<td>CTA</td>
<td>Commodity Trading Advisors</td>
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<td>CZCE</td>
<td>Zhengzhou Commodity Exchange</td>
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<td>DAP</td>
<td>Di-Ammonium of Phosphate</td>
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<td>DCE</td>
<td>Dalian Commodity Exchange</td>
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<td>DJ-USBSCI</td>
<td>Dow Jones-Union of Bank of Switzerland Commodity Index</td>
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<tr>
<td>EIA</td>
<td>U.S. Energy Information Administration</td>
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<tr>
<td>ETP</td>
<td>External Trade of Products</td>
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<td>HRC</td>
<td>Hot Rolled Coils</td>
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<td>ICA</td>
<td>International Commodity Agreement</td>
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<td>ICE</td>
<td>Intercontinental Exchange</td>
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<td>IEA</td>
<td>International Energy Agency</td>
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<td>IMM</td>
<td>International Monetary Market</td>
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<td>JKM</td>
<td>Japan Korea Market</td>
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<td>KBT</td>
<td>Kansas Board of Trades</td>
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<tr>
<td>LLDPE</td>
<td>Linear Low Density Polyethylene</td>
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<td>LNG</td>
<td>Liquefied Natural Gas</td>
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<tr>
<td>MAP</td>
<td>Mono Ammonium Phosphate</td>
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mb/d : million barrels per day
MCX : Multi Commodity Exchange of India
mmbtu : million British thermal units
NASDAQ: National Association of Securities Dealers Automated Quotations
NPK : Nitrogen (N), Phosphorus (P), Potassium (K)
NYCE : New York Cotton Exchange
NYMEX: New York Mercantile Exchange
NYSE : New York Stock Exchange
OECD : Organization of Economic Cooperation and Development
OPEC : Organization of Petroleum Exporting Countries
OTC : Over the Counter
SGX : Singapore Exchange
SHFE : Shanghai Futures Exchanges
SOE : State Owned Enterprises
SPGSCI: Standard and Poor’s Goldman Sachs Commodity Index
TSP : Triple Super Phosphate
USSR : Union of Soviet Socialist Republics
VAR : Vector Auto Regressive
WTI : West Texas Intermediate
WWII : World War II
Foreword

Financialization is a neologism now widely used in the media and political sphere, but also in the academic world. A concept that has acquired such importance and seems so well known that sometimes it does not need to be defined. The problem with this approach is not so much that this notion is ambiguous, but that the perimeter granted to it varies considerably. According to the Roosevelt Institute, this phenomenon is indeed characterized, in its most general sense, by “the growth of the financial sector, its increased power over the real economy, the explosion in the power of wealth, and the reduction of all of society to the realm of finance”.

On the other hand, in a much narrower approach dedicated to the commodity world, the phenomenon of financialization has often been defined as the growing importance of investment funds, such as ETFs, whose vocation is to offer their subscribers a financial performance resulting from the increase in commodity prices. With such diversity, delineating with the utmost precision the contours of a phenomenon whose economic and, in some cases, societal consequences are considerable, is essential.

In that connection, and faithful to its vocation to both fully engage in issues of interest to the African continent and to produce a number of studies or recommendations in the field of public policy, OCP Policy Center has invited a number of international experts to propose their analysis on the definition and stakes of the financialization of commodity industries. Despite the end of the so-called commodity “super-cycle” which has witnessed the dismissal of “long” speculation on ever-rising commodity prices over the period 2002-2012, this remains indeed an unavoidable topic with keenly debated but unanswered questions. What is the medium by which financialisation takes place? What are the implications for producers and consumers of strengthening commodity derivatives markets? Who are the main beneficiaries and what is to be feared? In particular, to what extent does financialization fuel speculation and exacerbate physical market instability? What are the recent trends in commodity market financialization and what will be its reality in the years to come? So many questions that call for answers.

In a first chapter, Pr. Helyette Geman reminds us, through a review of recent literature, that financialization is multifaceted and that it has therefore
been analyzed in a significantly varied way. Pr Geman also clarifies what was the responsibility of index funds in the very sharp rise in commodity prices over the first decade of this century. She dedicates the last part of her chapter to the analysis of a market that has not yet seen any financialization and which is of growing importance for the world and Africa: that of fertilizers. John Baffes offers us a different analysis by favoring a historical approach to the different price-setting mechanisms that prevail in the commodity world. In particular, the author’s ambition is to show how competitive pricing mechanisms have asserted or faded over the past two centuries. He reminds us that competitive pricing reemerged after the collapse of the Bretton Woods system with the introduction of financial derivatives, market-friendly policies, the shift to market-orientation of centrally planned economies, and the collapse of International Cartel Agreement. This question relating to the nature of price references on commodity markets is of particular importance because the notion of financialization cannot be reduced to the mere question of commodity index funds. The affirmation of a derivative market means, first and foremost, the emergence of a price that will not only serve as a reference for an entire industry but that will also be subject to both changes in the fundamentals of physical markets and to speculative dynamics. Pr. Luciano Gutierrez, in his chapter, focuses on the analysis of agricultural markets, which we know were at the heart of the debates surrounding the dangers of financialization. In addition to identifying the main benefits but also the risks associated with this profound change, Luciano Gutierrez proposes an econometric analysis based on the VAR methodology to measure the impact of financialization on corn, wheat and soybean price formation. In this context, he shows that this phenomenon has amplified food price movements with spot prices for maize and wheat being influenced by financial variables in the short-run. Yves Jégourel also examines financialization in the context of specific commodity markets: primary aluminum, iron ore and steel. These choices have not been made randomly for each of these minerals/metals strongly illustrates that the path towards greater financialization is not unique. In this context, he suggests that the specific nature of the conundrum that links the financialization process to the industrial organization that produces, processes, trades and consumes a given commodity should be investigated. With regards to the fifth and final chapter of this report, Pr. Michael Tamvakis focuses on Chinese commodity derivatives markets. After briefly recalling the history of these markets and describing the reality of futures contracts which are traded on the Dalian Commodity Exchange, on the Zhengzhou Commodity Exchange or on the
Shanghai Futures Exchange, Michael Tamkavis looks at their performance and discusses the next steps that could make China a country with reference derivatives markets.

This report would probably not have been possible without the close relationship that the OCP Policy Center has with the academic world and its researchers, whether senior fellow of the OCP Policy Center or not. It is one of many contributions from the OCP Policy Center and I can only invite our readers to consult on our website.

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PART I

THE PATTERNS OF COMMODITY FINANCIALIZATION
CHAPTER 1

Fertilizers Markets: In Search of the Index of Choice

Helyette Geman

Abstract

The goal of the paper is twofold: i) Re-examine the different definitions that ‘financialization’ has conveyed in the large recent literature on commodities; ii) argue in favour of visible indexes in the creation of reliable derivatives markets, taking the remarkable example of the Liquid Natural Gas indexes and inferring some lessons for the creation of derivatives in fertilizer markets

Keywords: Fertilizer Indexes, LNG indexes, Fertilizer derivatives, Financialization
I. Introduction

Commodity markets usually have greatest liquidity in Futures markets rather than spot markets, as the former allow both producers and consumers to ‘lock in’ a price in advance, for example a farmer wishing to secure a price for his cereals long before the harvest time, or a construction company taking away the randomness in the price of copper they will use several months later.

The last two decades have seen a very large increase of commodity-related investments by financial institutions as well as retail investors. Over the last ten years, an intense academic debate has emerged about the potential implications of these developments, with some suggesting the ‘financialization’ of commodity markets – this term representing altogether the impact of the rising presence of non-commercial players on commodity prices, volatility, or even markets not functioning properly.

In Section 2, we review the different methodologies and results of the main literature on financialization. In Section 3, we examine the natural gas and iron ore indexes during the recent period in order to try to infer some possible ways ahead for the fertilizers market. Section 4 concludes.

II. Financialization of commodity markets: A buzz or a reality?

Fattouh et al (2013) argue that most of the studies on financialization of oil markets can be classified into various strands of literature, the most preeminent being:

- analysis of the co-movements between commodities and stock prices
- influence of Futures trading positions on future spot prices
- relationship between Future and spot prices
- relationship between prices and inventories
- effect of supply and demand shocks
- influence of time-varying premia

Obviously, financialization as a causal chain may be one representation of the term: increased Futures trading, particularly by financial market participants, leads to changes in Futures prices, which in turn may affect spot prices through the spot-forward relationship that holds at date t between the spot price S(t) and the price F(t,T) of the Future contract maturing at date T.
\[ F(t, T) = S(t) [1 + (r-y) (T-t)] \]

We can note that an increase on the Future price because of heavy financial trading creates in turn an increase in the spot price only if one can prove that the difference between the cost of financing \( r \) and the convenience yield \( y \) remains constant across these trading activities. It is doubtful that the financial activity has no influence on the convenience yield, meaning that the impact of a defined move \( F \) on the spot \( S \) has a clear direction, while there is strong evidence, that commodity prices and volatility drive trading positions, like in the oil market of the years 2015 and 2016.

From a methodological perspective, Fattouh et al (2013) and Kilian and Murphy (2014) conclude ‘no’ to the financialization of crude oil markets. Till (2016) returns to the investigation of the oil market during the year 2008, where the ‘boom and bust’ is perceived in Singleton (2014) as due to speculative trading and argues that markets participants classified as ‘managed money’ and ‘swap dealers’ did reduce their positions in the oil market in the months preceding the July 2008 price spike. This is displayed in Figure 2 below that provides over the period 2006 to 2009 the COT (Commitment of Traders) which represents these ‘non-commercial’ traders and is published weekly by the CFTC (Commodity Futures Trading Commission). On the other hand, the US Energy Information Agency reported declining numbers for the OPEC oil excess capacity during the year 2007, to reach in the second quarter of 2008 half the value it had at the beginning of 2007. Let us note that the collapse of oil prices during the second half of 2008 and exhibited in Figure 1 was due in great part to the financial crisis fully coming into the news and market participants, whatever their type, liquidating as many positions as possible to pay the margin calls on those positions they could not close because of their global activities or because of illiquidity.
Figure 1: The Rapid Decline in Oil Prices over the second half of 2008

![Rapid Decline in Oil Prices over the second half of 2008](image)

Figure 2: Positions of Non Commercial Players (From COT) versus Oil Prices over the period 2006 to 2009

![Positions of Non Commercial Players (From COT) versus Oil Prices over the period 2006 to 2009](image)

Also on the methodology side, Cheng and Xiong (2014) view the most commonly used instruments of standard correlation analysis and Granger causality tests as essentially inconclusive. They argue that studies using unconditional tools assume that changes in positions observed in the markets are all due to shifts in the demand of financial traders, while in fact hedgers may move around their positions as well. Using classical autoregressive analysis does not allow one to capture these dynamically changing effects and sharper tests are necessary.
Lastly, we can observe that the oil forward curve, represented in Figure 3 for both WTI and Brent in February 2015, have exhibited an increasing slope (called contango) since the end of summer 2014, representing the view of market participants and the prices below which sellers would not agree to sell for distant maturities. This shape offers a rare and sure opportunity of ‘carry arbitrage’ - also well-known in the world of currencies when feasible - namely buy the spot at date t = Feb 4, 2015, sell a Future contract maturing in one year for instance (T = t + one year) at the price F(t, T) and at maturity generate a sure profit represented by the difference between F(t, T) received upon delivery of the barrel minus the cost of financing and storage over the period, namely

\[ F(t, T) - S(t) \left[ 1 + r (T - t) + c (T-t) \right] \]

Where r represents the cost of financing and c the cost of storage expressed above as a percentage of the price but could also be a number in dollars.

**Figure 3: WTI and Brent Forward Curves on Feb 4, 2015**

Despite the so-called ‘financialization’ of the markets, the buyers of Future contracts have not forced down the contango shape which continues to prevail after three years; the arbitrage opportunities are just limited by the available storage as barrels of crude oil cannot be stacked anywhere. In fact, storage is taking place now in the form of ground storage, floating storage or even using idle tankers on routes which are less active because of new centers of production. Reports from the companies indicate that during the first quarter of 2015, when the contango
spread reached $13, the major oil companies Royal Dutch Shell, BP and Total had a record level of carry trade activities and gained in trading the forward curve $300 to $400 million more trading the forward curve than in a standard quarter.

Our argument is in fact that the physical part of the activity in commodities has never been as an important component of the picture, as exhibited by the problems created for the LME/ Hong Kong Exchange by the unprecedented queues that took place in the delivery of metals in LME-registered warehouses during the years 2010 to 2014. These created a significant additional ‘delivery premium’ paid in large storage fees for those holding long positions in Futures, pushing up the so-called physical price of the metal, where

\[
\text{Physical price} = \text{LME Future price at date } T + \text{Delivery Premium}
\]

Obviously, the rise in the physical price immediately impacted the spot prices at that time, to the detriment of metal consumers like Coca Cola or General Metals, and to the benefits of mining companies (see Stevens and Zhang, 2016). These delivery delays were much more effective in pushing metal prices in the spot market than any episode of financial players’ activity.

1. The case of agricultural commodity prices

The spike in international prices of cereals that took place over the period 2007-2008 has also been the subject of a clear disagreement in the academic literature on the origins of this spike. Gilbert (2010) views there a clear influence of the non-commercial players. Wiggins et al (2010) attribute the spike to the conjunction of a variety of factors such as poor harvests, low cereals stocks, production of ethanol from corn in the US and Brazil as well as trade restrictions (such as the Russia export ban) affecting the supply side, while the rapid growth of the world economy, in Asia in particular, had created a rising demand for cereals. Geman and Ott (2013) find that financial trading in agricultural markets could lead to episodes of high volatility, but had no clear impact on prices.

In a well-quoted paper, Irving and Sanders (2012) argue that the available literature indicates that the irrational and harmful impacts of the structural changes in the commodity markets over the previous decade have been minimal, mentioning in particular the fact that there is little evidence that passive index investment caused a bubble in commodity Futures prices. They suggest instead an intriguing evidence of several beneficial impacts of the structural changes over
that time period, in particular the fact that expanding market participation may have decreased the risk premiums, where the risk premium is classically defined by

\[ F(t,T) = \text{Expect} \{ S(T) / \text{Information at date } t \} + \text{risk premium} \]

When there are a large number of hedgers in the market selling their production in the Future market, the premium will be negative. With a greater participation of financial players willing to buy these Futures, obviously the risk premium will be lower; price volatility will also be lower, both in the spot and Futures markets.

**Figure 4: The Spike in Wheat and Corn Prices in 2007/2008**

![Graph showing the spike in wheat and corn prices in 2007/2008](image)

**2. The case of metals**

Geman and Smith (2013) look at the six base metals traded on the London Metal Exchange during the period 1998 to 2012 that includes the sub-period of rapid price rise from 2002 to 2008, the collapse at the time of the 2008 financial crisis and the rebound as of 2009 created by the rapid growth of China and the gigantic demand for copper in the direction of construction, infrastructure and electricity grids. They demonstrate that the Theory of Storage linking the slope of the forward curve to inventory was remarkably validated over the period of analysis, and even more so when inventory was expressed in terms of days of
consumption, concluding there was no evidence of ‘financialization’ of metals markets.

Figure 5 shows the remarkably steady growth of the cumulative trading of the 6-month copper Future contract on the London Metal Exchange over the period 2005 to 2016. Note that the amount of money invested in commodity indexes was vastly reduced after the financial crisis of 2008; this is not reflected in the graph, confirming that copper Futures trading was greatly triggered by mining companies wishing to hedge their production, and consumers of copper worldwide, Asia in particular, hedging their consumption.

**Figure 5:**

![Cumulative volume LME 6-month contract](image)

3. The latest developments on financialization

Some academic papers lately proposed ‘models’ of financialization. Basak and Pavlova (2016) take as a definition of financialization the inflow of institutional funds into commodity Futures markets and introduce a model leading to the unusual result of commodity spot prices going up with financialization. Among all commodities, crude oil is the one where the trading activity in Futures is the largest and has been for a long time. However, oil prices are very low today, compared to their price over the last 15 years, because of the fundamental rule of supply and demand, the big production of shale oil in the US and the necessity for a number of OPEC (and non OPEC) countries to keep their production at a minimal level.
to guarantee a minimal income to their citizens. Moreover, looking at the daily moves of oil prices over the year 2017, we see instead prices going down with any news of increase of inventory, in agreement with the intuition as well as the Theory of Storage of Kaldor (1939) and Working (1949). Returning to the liquid and transparent oil market, the Brent index climbed by 0.5%, meaning a large move in a single hour of trading on July 26, 2017 upon the announcement by the US Department of Energy that inventory had decreased by 7.2 million barrels to 483 million versus the reduction of 2.6 million barrels expected by the consensus.

III. Searching for the index of choice in fertilizer markets

Surprisingly, the interesting subject of fertilizers has been under-investigated in the academic literature so far. Geman and Vergel (2013) analyze the spike in fertilizers that followed in 2008 the spike in wheat and corn prices, and exhibit that hedge funds and asset managers who would have invested in fertilizer-mining companies during that year and the following ones would have generated on their shares a very large ‘alpha’, on top of the return provided by their ‘beta’.

The fertilizer market is volatile, with high volumes traded and a necessity for price risk management. The spike of 2008 in fertilizer prices is depicted in Figure 6. It was at that time that many traders in the world of commodities discovered the importance of fertilizers as a sub-class of the agricultural space. Hostile take-overs, successful or failed like the one on the Canadian company Potash Corp in 2009, were another element that drew the attention of financial investors to the family of fertilizers.

FIS the brokerage firm which had already been active for many years in the market of freight swaps – hence the first letter of its name, had added to its activities in the early 2000s the facilitation of cash-settled fertilizer swaps, with such underlyings as Phosphate, Potash, Urea, DAP (Di-Ammonium of Phosphate) represented by indexes ranging from DAP Tampa FOB index, the Urea Egypt FOB index or Urea FOB China. The spike in all fertilizer prices in 2008 was obviously followed by a large increase of the volumes traded in these instruments as of 2008.

The Chicago Mercantile Exchange started trading Futures contracts written on
Urea on its European Exchange in September 2015. Prior to that date, swaps on DAP, Urea and Urea Ammonium nitrate have been cleared through CME Clearing, with the flexibility for the parties to negotiate their own prices as well as the size

**Figure 6: The Spike in Fertilizer Prices in 2008**

On the information side, a few companies have been the key providers: ICIS, which was one of the world’s largest petrochemical information providers, added years ago a fertilizer division. The firm Profercy launched in 2004 its Profercy Nitrogen Service. Since then, it has grown into an important provider of global fertilizer prices’ analysis, adding services on phosphate and potash, covering the DAP, MAP, TSP and NPKs, as well as Phosphate Rock and Phosacid.

In October 2015, the company FIS decided to start using the average of ICIS and Profercy weekly prices as the settlement index for FIS – brokered OTC fertilizer swap trades. This index is also the one utilized on the Chicago Mercantile Exchange Clearing platform, hence vastly reducing the ‘basis risk’ of trades on the same underlying settling against different indexes. Obviously, the development of the liquidity in swaps traded on various platforms should bring consistence of the prices on one hand, as well as the creation of Futures contracts, which are nothing but the stripping into single-maturity contracts of swaps.
1. Lessons from other commodity markets

One commodity which can arguably be compared to fertilizers is iron ore: it is also mined, and producers and consumers face the same type of hedging problems. Moreover, iron ore is one of the biggest traded and shipped bulk commodities.

In contrast to the base metals – copper, nickel, lead, tin, aluminium – which have been traded on the London Metal Exchange for a long time (the LME was founded in 1877), iron ore, the key ingredient with coke in the production of steel, was only traded in long term fixed price contracts upon the decision of steelmakers. In 2010, the world’s top three iron miners – Vale from Brazil and the two Anglo-Australian companies BHP Billiton and Rio Tinto – decided to act together and move the bulk of their contracts to a quarterly pricing system. It received a fierce resistance from steelmakers, in particular from China which was the top iron buyer; the majority of traded iron ore was at the time traded against an annual price benchmark defined by a negotiation between producers, trading houses and steel mills. But the three miners were controlling in 2010 seventy per cent of the iron seaborne trade and the change was enforced, turning later on to a monthly pricing.

Figure 7 shows that, as of the beginning of the year 2009, iron swaps started trading, and the volume increased rapidly as of February 2010, with the collapse of the long-term contracts. Since then, Futures on iron ore and steel have been introduced, in China in particular. Iron ore and steel rebar Futures are now traded on three Chinese Commodity Exchanges in particular.

Figure 7: The Trading Volume in Iron Swaps in 2009 and 2010
A Fierce competition to be the liquid natural gas ‘Index of choice’

Another commodity whose comparison with fertilizers should be introduced is Liquid Natural Gas. Because of the cost of large LNG tankers across long distances, LNG markets have been characterized by long term contracts; moreover, because the suppliers were often producing crude oil and wanted to simplify their hedging activities, the prices in these contracts were indexed to crude oil, exactly like the prices of natural gas imported into Europe from Russia or Algeria. These two features are disappearing from LNG markets, in particular because oil prices have collapsed and the oil indexation is not any more valuable to the sellers.

Figure 8: Sling Price trajectory starting in Jan 2016

On the other hand, the gigantic production of shale gas in the US, together with the greater availability of LNG tankers because of new technology, has triggered a large price reduction not only in the US but also in Europe and Asia – where Japan has become a large consumer of natural gas for electricity production after the Fukushima disaster (and the world’s largest importer, followed by South Korea). In the US, prices are now in the range of 3 to 4 dollars; in Asia, they remarkably went from $18 in 2014 to roughly $8 in the recent period. And we are moving from a picture where natural gas markets were segmented into three regions to a situation where LNG tankers, some of them of smaller size, are roaming the world, creating de facto a global and prepared to immediate delivery, creating de facto a spot market for LNG. Jegourel (2016) observes that this is likely to create
a greater volatility in LNG prices, hence a need for risk management and in turn the need for Futures contracts written on LNG.

Natural gas is seen by some experts as the fuel of the future and is predicted to become the main fossil fuel by 2035 as it is cleaner than coal and oil, and abundant and affordable as of now. The IEA Energy Outlook 2016 predicts that the industrial sector and power generation combined will account for 73% of the total increase in the world’s natural gas consumption. We wish to note that natural gas is very important to Morocco, in the next decades, for use in electricity production and industrial activities. The country launched in December 2014 a national plan for the development of Liquid Natural Gas, involving the construction of an LNG terminal and a re-gaseification plant in the port of Jorf Lasfar, the export hub of phosphates.

LNG cargoes used to be traded several years ago through opaque bilateral deals. These have been replaced by open sell and buy tenders for multiple and single cargoes, brokered trades and also speculative positions taken by non-traditional players.

The Singapore Exchange (SGX) wishes to establish itself as a dominant player in the LNG market. The North Asia Sling (Singapore LNG Index Group), whose price trajectory is described in Figure 8 and forward curve prevailing on August 2, 2017 in Figure 9, is based on LNG cargoes delivered to ports in Japan, Korea, Taiwan and China – economies which represent 60% of global LNG demand.

The Future contract is related to a volume of 1000 MMBtus (roughly the equivalent of 28,000 m3) in order to encourage liquidity, and it is financially settled. The forward curve shows that, except for the Future price trades between $5 and $6 per MMBtus, except for the winter season where one dollar is added to the price.
Another major index is the benchmark Platt’s daily DES LNG Japan Korea Marker (JKM), which has benefited from the notoriety of Platt’s in the petroleum sector. The JKM is the price assessment for spot physical cargoes delivered ex-ship into defined ports of Japan and South Korea, aboard ships whose capacity is comprised between 135,000 and 175,000 m³. Futures written on the JKM index are monthly contracts, size 10,000 MMBtus and available for 60 months ahead at this point; they are cash settled and cleared by the InterContinental Exchange (ICE).

Interestingly, the information provider ICIS mentioned above for fertilizers also covers the petrochemical and energy industry and publishes a DES LNG spot price for East Asia, very similar to JKM.

The company RIM Intelligence provides RIM/CME daily LNG spot prices based on a survey of concluded bids. All swaps related to the RIM index are also cleared on CME Clearport, the Clearing House of the Chicago Mercantile Exchange.

We can observe that all these indexes are related to LNG in Asia, a region of vibrant consumption versus production. Major Exchanges make their best efforts to be present in the development of these LNG Futures, from ICE to the CME and the Singapore Exchange. The recognition of the index fuels the trading volume and conversely, in a virtuous cycle for which the Exchanges are competing.
IV. Conclusion

We have reviewed in this paper the different definitions and methodologies around the expression ‘financialization’ of commodity markets. Taking the examples of crude oil, metals and agriculture, we have shown that the activities of non-financial players do not really move spot prices in one direction or the other; they may just increase the volatility during some time periods. Inventory, on the contrary, is a fundamental element in a commodity space: it is remarkably related to the slope of the forward curve when a Futures market exists; it is in all cases related to commodity prices and volatility.

Regarding the way forward in fertilizer markets, we have analyzed two important examples of ‘spotization’, namely natural gas and iron ore, commodities which are both key components of the world economy. Interestingly, in the case of iron ore, it was the major mining companies which forced the replacement of long term contracts by prices changing first every quarter, then every month, and a true spot market at this moment in time, complemented by Futures contract trading.

For natural gas, the ‘spotization’ is taking place by means of a number of competing indexes, as commodity pricing benchmarks represent a ‘winner-takes-all’ game. The information provider, Platts, which has been a respected name in the oil markets for decades. This trust was transferred to the Japan Korea Marker (JKM) they have been publishing for a few years and which gained attention because of the volumes attached to this vibrant part region of the world, in particular because of the large consumption by Japan of natural gas after the Fukushima tragedy. The visibility of the Platts Japan Korea Marker (JKM) has facilitated a large number of financial trades which are now cleared by the Chicago Mercantile Exchange clearing platform.

Interestingly, both avenues are open for the fertilizers markets and will depend on the identities of the ‘first movers’ in launching Futures (see Geman 2005). However, we can observe that the existing information providers on prices of phosphate, urea and potash do not have a long history in the agricultural markets and need to build it among farmers and co-operatives in order to bring this large number of natural players into the space of fertilizer derivatives.
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CHAPTER 2

Competitive Price Benchmarking in Global Commodity Markets: What Can History Teach Us?

John Baffes

Abstract

Globally, commodity price benchmarks influence the price at which most commodity transactions take place. Competitive benchmark pricing, which flourished in the late 1800s, suffered from post-depression protective trade policies, which were followed by post-WWII policies, including the Bretton Woods arrangement, absence of pricing mechanisms in centrally planned economies, proliferation of International Commodity Agreements, commodity subsidization by high income countries, and industrialization policies by developing countries. These policies were often complemented (and facilitated) by strong commercial interests. Competitive pricing reemerged after the collapse of Bretton Woods with the introduction of financial derivatives, market-friendly policies in both OECD and developing countries, the shift to market-orientation of centrally planned economies, and the collapse of ICAs. Today, most commodities are priced in a competitive manner; the ones that are not, reflect mostly physical characteristics rather than policy impediments. Notwithstanding this achievement, a new issue has emerged—the financialization of commodities. While some view financialization a major impediment to competitive pricing, other consider it the zenith of competitive pricing.

KEY WORDS: Benchmarking, Commodity markets, competitive pricing, futures markets, spot prices
"The natural price, therefore, is, as it were, the central price, to which the prices of all commodities are continually gravitating. Different accidents may sometimes keep them suspended a good deal above it, and sometimes force them down even somewhat below it. But whatever maybe the obstacles which hinder them from settling in this centre of repose and continuance, they are constantly trending towards it."

Adam Smith (1789, Chapter V, “Of the real and nominal price of commodities, or their price in labour, and their price in money”)

I. Introduction

Global commodity price benchmarks, principally formed at futures exchanges (and less often at auctions), influence the price at which most commodity transactions take place. Global price benchmarks first appeared in the mid-19th century when the speed of information transmission was decoupled from the speed at which commodities moved. That, in turn, enabled some markets to incorporate information on demand and supply conditions that went beyond the geographical coverage of the market in question.

Competitive benchmarks for agricultural commodities (first cotton and later grains) were fully developed by the end of the 19th century. Benchmarks for commodities intended for industrial use, however, emerged much later. For some commodities, such as iron ore and natural gas, competitive benchmarking is still ongoing.

This paper discusses the related (but not identical) concepts of price benchmarking and competitive pricing and identifies the conditions under which the former emerged and flourished in the mid- to late-19th century. It also discusses the demise of competitive pricing from the 1929 depression to the collapse of Bretton Woods as well as their reemergence. The paper concludes that government intervention, commercial interests, and the nature of the commodity are key determinants of when (and if) a global price benchmark is developed.

The rest of the paper proceeds as follows. The next section looks at the history of competitive benchmark pricing in commodity markets, including its post-1929 collapse. Section 3 discusses the rebirth of competitive pricing following the collapse of Bretton Woods, including the development of global financial markets.
The formation of competitive price benchmarks in four industrial commodities (crude oil, coal, iron ore, and natural gas) is discussed in section 4. Section 5 summarizes the impediments to (and consequences from) competitive pricing, including the emerging issue of “speculation.” Section 6 concludes. Appendix A elaborates on how international communications and the transatlantic (and other) cable(s) facilitated the formation of price benchmarks in the global cotton market, the first global commodity market. Appendix B offers some econometric analysis on the pricing mechanisms of the natural gas market, perhaps, the last important commodity without a global price benchmark.

II. A brief history of competitive pricing in commodity markets

1. Early history of competitive pricing

Commodity trading goes back to antiquity. The Silk Road, an ancient network of trade connected the Far East (including the Korea peninsula and Japan) with the Mediterranean (Elisseeff 2001; Xinru 2010). The Silk Road, however, facilitated mostly high valued commodities, including precious metals, spices, and as the name suggest, silk. Commodity trade expanded significantly with the use of transoceanic travel. The East India Company, the oldest among a number of similar companies, facilitated commodity trade between the Europe (mainly Britain) and the India Subcontinent (Wilbur 1945). A similar company, the West India Company operated by the Dutch, facilitated commodity trade between Europe and Latin America and the Caribbean (Boxer 1957). The London Tea is, perhaps, the longest running commodity market. It began operations in 1679 and became the world’s most important tea pricing center.¹

Futures trading goes as far back as the late 1600s where sporadic commodity trading was taking place in Amsterdam (Goss and Yamey 1978; Stringham 2003). Historians, however, have credited Japan with the birth of futures trading where futures were formally traded at the Dōjima rice market in Osaka in 1730 (Markham 1987; Schaebe 1989). Key characteristics of the Dōjima market were the central clearing of contracts, contract standardization, mark-to-market accounting rules, and the concept of settlement price (referred to as the “fuse cord price”) which was used as the next session’s opening price.

¹ The last trade of the London Tea Auction took place on June 29, 1998. Today’s international tea auction is in Mombasa. Other important auctions are Kolkata and Colombo (Fernando 1998).
Competitive price benchmarking as it is known today, however, began during the mid-1800s in two parallel tracks: First, in North America where Chicago became the trade hub for various grains. Second, on the two sides of the Atlantic where the global cotton market emerged which included various trading hubs such as Alexandria, Liverpool, New York, and New Orleans.

The Chicago Board of Trade (CBOT) was founded in 1848 to facilitate cash transactions for grains and shortly forward contracts (“to arrive”) contracts began trading (Williams 1986). Grain traders in Kansas followed suit by establishing the Kansas City Board of Trade. In 1859, the Illinois legislature assisted the CBOT by granting it self-regulatory authority over its members and introducing standardization of contracts. Shortly thereafter, formal trading rules are instituted regarding delivery procedures while in 1868, rules banning “corners” were adopted (CFTC 2017). These actions marked the beginning of futures trading in CBOT of wheat, corn, and oats.

Almost parallel to the development of grain markets in Chicago, a global cotton market was also developed. Its origins go back Liverpool where, according to (Dumbell 1927), cotton trade was taking place as early as the mid-18th century. Cox (1925) also refers to speculation at the Liverpool market in the beginning of the 19th century. The Liverpool Cotton Exchange began trading early versions of futures contracts in the 1840s making it the first global cotton pricing center as it was importing cotton from various origins to supply its textile industry. Cotton futures contracts we also traded at the Alexandria Cotton Exchange as early as 1849, although the Exchange it was formally established in 1861, (Baffes and Kaltsas 2004).

2. Information technology and the emergence of competitive price benchmarking

Developments in information technology—steamship and telegraph—were instrumental for changing the price formation process in futures exchanges by considering, for the first time, non-local demand and supply conditions. With the expanded use of the steamship during the 1840s, the time to cross the Atlantic was reduced from two months to two weeks. This allowed information of cotton demand and supply conditions in the U.S., the major supplier to Britain at the time, along with cotton samples to arrive much earlier than cotton itself. Based on this information, merchants in Liverpool were trading “to arrive” or “in transit” contracts, more than one month prior to the physical transaction, in turn forming
the basis for forward and futures contracts (Dumbell 1927). Perhaps, the single most important event behind the transformation of the cotton industry into a global market was the successful installation of the transatlantic cable in 1865 (Appendix A summarizes the history of the transatlantic cable). Information on market conditions in the United States was transmitted instantaneously to Europe and vice-versa.

The effects of the steamship and the transatlantic cable on the cotton pricing are summarized by Dumbell (1927, p. 259):

“So long as cotton and news travelled across the sea at the same pace there could be no volume of dealings except in cotton on the spot. But as soon as the mail steamer, carrying letters and samples, outstripped the sailing ship with its cargo of cotton, that cargo could be bought and sold while still at sea. The gradual extinction of the sailing ship would have eliminated the time interval which made that practice possible, but in the meantime the telegraph came to magnify and perpetuate the difference between the transmission of news and the shipment of cotton”.

Indeed, with information travelling instantaneously across the Atlantic, the trade of contracts ‘to arrive’ (the forerunners of futures contracts) opened up opportunities for speculative returns to information as Marsh (1911, p. 592) elaborates:

“In 1868 or 1869, Mr. Rew saw that the newly laid Atlantic Cable made it possible for a cotton merchant in Liverpool to ascertain with unheard-of quickness the price at which actual cotton could be bought in the southern states [of the United States] and the approximate date at which it could be shipped to England. He saw, also, that if the price that was being bid in Liverpool for “cotton to arrive” was high enough to enable him to buy cotton in the South and sell contracts for this same “cotton to arrive” in Liverpool, two or three months later, he could enter onto the transaction with entire safety, as when his cotton reached Liverpool, he could either deliver it to the parties to whom he had sold the contracts; or, if some spinner was willing to pay a higher relative price than the holder of the contracts had agreed to pay, he could buy back his contracts and sell the cotton to the spinner with the larger profit to himself”.

The degree to which information technology facilitated the formation of the
global cotton price benchmarks can be seen in Figure 1. Both New York and Liverpool cotton markets were supplied by cotton produced in the Southern United States. Prior to 1825 cotton prices were uncorrelated. That began changing when the first steam ships began crossing the Atlantic during the 1820s. In addition to the shrinking gap between New York and Liverpool prices, the price correlation increased, in effect confirming the emergence of a cotton price benchmarks that were influenced by global supply and demand conditions.²

**Figure 1: Cotton prices, 1790-1897**

By the end of the 1880s, five cotton futures exchanges were connected by cable (Alexandria, Le Havre, Liverpool, New York, and New Orleans), in turn rendering the cotton market the world’s first global competitive pricing mechanism (Baffes and Kaltsas 2004). The telegraph played a key role in the United States as well, according to Williams (1982, p. 312): “Although the western ports did not get a telegraph until 1848, Buffalo and New York were connected in late 1846. Perhaps then, the flurry of trading in 1847 accompanied the introduction of the telegraph.” The global cotton market in conjunction with the well-developed commodity market in Chicago (and New York) set the stage for the golden era of competitive commodity pricing.

² A logarithmic regression of New York on Liverpool cotton prices gave an R² of 0.06 during 1790-1825. The R² increased to 0.93 for the 1826-64 and to 0.95 during 1865-96. All other conventional and stationarity statistics confirmed the stronger price link.
3. The post-1929 downfall of competitive price benchmarking

The advances in competitive price benchmarking of the late 19th and early 20th centuries were soon to be reversed. The first setback was a Great Depression-era casualty, following the passage of the U.S. Tariff Act of 1930 (also known as Smoot-Hawley Tariff), which introduced high tariffs (Irwin 1998). Numerous trading partners of the United States retaliated, which was a severe blow to international trade. Although the harmful effects of these policies were soon understood, post-WWII policies were built around interventionist mentality and therefore did not improve competitive pricing. Indeed, the post-WWII the agricultural subsidy mechanism is, in some cases, still in effect today (Tyers and Anderson 1992; Baffes and De Gorter 2005).

A telling example of how government intervention impacted competitive benchmark pricing is the near-death experience of the New York cotton Exchange (NYCE). During the 1960s and 1970s, the Commodity Credit Corporation (CCC) bought and sold most of the US cotton, thus eliminating the need for hedging. For example, during 1962-66, the CCC accounted for almost two thirds of cotton inventories (Hieronymus 1977). The government’s interference in the cotton market almost caused the demise of NYCE. In 1966 the Exchange traded only 730 contracts—a daily average of three contracts—prompting Parry (1982, p. 82) to write: “Despite the low turnover, the New York Cotton Exchange did not die.” Indeed, futures trading activity and public stockholding are highly (and negatively) correlated (Figure 2).

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3 The country grouping names used in this section reflects the political delineation used at the time: First World countries (United Stated, Western Europe, and their political allies), Second World countries (centrally planned economies including the USSR, China and their respective spheres of influence) and Third World countries (not politically aligned with First of Second world countries, later becoming synonymous with low income countries).

4 CCC oversaw the stabilizing, supporting, and protecting farm income.

5 A regression of the logarithm of NYCE volume on CCC stock share gave a parameter estimate of -2.28 (t = -5.26, R2 = 0.73).
While competitive price benchmarks in the First World countries was severely damaged, they did not exist at all in Second World countries where production decisions were based on targets set by central planning committees. The absence of price signals led to poor investment choices and (often) disastrous outcomes. Craumer (1992), for example, reported that following a high adoption rate of mechanical cotton harvesting in the USSR (which reached almost 70 percent in early 1980s, even higher than the United States), declined to less than 50 percent in the late 1980s, and it is almost zero now—with a few exceptions, cotton in Central Asia is hand-picked. Pomfret (2002) argued that mechanical harvesting was a misplaced investment strategy and estimated that its costs may have exceeded $1 billion in 1960 prices. Similarly, the absence of water pricing led to massive expansion of irrigation, which was achieved by diverting the Amu Daria and Syr Daria rivers to USSR’s cotton producing region (located in today’s Uzbekistan), causing the drying of the Aral Sea (Glantz et al. 1993; Spoor 1998).\(^6\)

Interventions that impeded competitive pricing were common in Third World countries as well. These interventions originated from First World countries (Baffes and Etienne 2016). Kindleberger (1943), the chief architect of the Marshall Plan, was also an early proponent of industrialization, argued (p. 349):

\[^6\] The Time magazine (May 3, 2010) named the drying of the Aral Sea one of the world’s top 10 environmental disasters: “What was once a vibrant, fish-stocked lake is now a massive desert that produces salt and sandstorms that kill plant life and have negative effects on human and animal health for hundreds of miles around. Scores of large boats sit tilted in the sand—a tableau both sad and surreal.”
“... the terms of trade move against agricultural and raw material countries as the world’s standard of living increases (except in time of war) and as Engel’s Law of consumption operates. The elasticity of demand for wheat, cotton, sugar, coffee, and bananas is low with respect to income. If the agricultural and raw material countries want to share the increase in world’s productivity, they must join in the transfer of resources from agriculture, pastoral pursuits, and mining to industry”.

Industrialization policies, which dominated the post-WWII development agenda, set the stage for the formation (or continuation from the colonial era) of commodity parastatals in most resource-dependent countries. These parastatals, which often handled all marketing and trade aspects of commodities, typically included panseasonal and panterritorial price regimes and became the norm, especially in Africa.

Lastly, price benchmarks for many commodities were influenced by International Commodity Agreements (ICAs). The objective of most ICAs was to stabilize prices through mechanisms such as global buffer stock management or trade regulation. The included commodities such as coffee, cocoa, sugar, tin, and natural rubber.

All these interventions not only weakened the global benchmarking mechanisms in agricultural commodities but also stopped progress for the competitive pricing in the industrial commodities. Indeed, during 1945-71 prices of energy commodities such as crude oil and precious metals such as gold, changed very little (Figure 3). Similarly, changes in exchange rates took place very frequently until 1971, since they were governed by the Bretton Woods arrangement. Not surprisingly, the absence of competitive pricing along with the public ownership of resources created rent-seeking conditions (Krueger 1964). In fact, Hieronymus (1977) and Carlton (1984) cited commercial interests as a key reason for the failure of commodity futures contracts.
III. The reemergence of competitive price benchmarking

Yet, the commodity-related government interventions did go without criticism. Johnson (1947) argued that the agricultural sector should not be subjected to interventions. Friedman (1954) disputed the benefits of managing income variability for commodity producers. Johnston and Mellor (1961) criticized pro-urban policies pursued by many developing countries. However, it was not until the early 1970s when the shift towards competitive pricing began. On August 15, 1971, the Nixon Administration ended convertibility of the US dollar to gold, effectively paving the way to flexible exchange rate arrangements as well as competitive pricing in the gold market.

Interestingly, even before the collapse of Bretton Woods, the Chairman of Chicago Mercantile Exchange, the world’s most prominent futures trading center, identified the need (and opportunity) for competitive benchmark pricing in financial markets (Melamed 2011, p. 633):

“In 1971, as chairman of the Chicago Mercantile Exchange, I [Leo Melamed] had an idea: a futures market in foreign currency. It may sound so obvious today, but at the time the idea was revolutionary. I was acutely aware that futures markets until then were primarily the province
of agriculture and—as many claimed—might not be applicable to instruments of finance. Not being an economist, the idea was in need of validation. There was only one person in the world that could satisfy this requisite for me. We went to Milton Friedman. We met for breakfast at the Waldorf Astoria in New York. By then he was already a living legend and I was quite nervous. I asked the great man not to laugh and to tell me whether the idea was “off the wall.” Upon hearing him emphatically respond that the idea was “wonderful,” I had the temerity to ask that he put his answer in writing. He agreed to write a feasibility paper on “The Need for Futures Markets in Currencies,” [Friedman 1971] for the modest stipend of $7,500. It turned out to be a hell of a trade”.7

On May 16, 1972, the Chicago Mercantile Exchange launched seven currency futures contracts through its newly established International Monetary Market (IMM). After a slow start (0.2 million contracts were traded during 1972-76) trading of currency futures grew to reach almost 12 million contracts by 1983, rendering IMM the world’s leading financial derivatives institution (Clifton 1985). The gold pricing mechanism (the so-called London price fix) soon regained prominence.8

Figure 4: British pound per US dollar

![Graph of GBP/US$ nominal from 1960 to 2015.](image)

Source: St. Louis Federal Reserve Bank.
Note: Last observation is August 2017

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7 The Chicago Daily News, reported on December 20, 1971: “The Chicago Mercantile Exchange today announced plans to develop a futures currency. The commodities market which up to now has dealt with items such as pork bellies, shrimp, eggs, and live cattle, also said it has retained Prof. Milton Friedman of the University of Chicago to analyze the feasibility and need for such a market.”

8 On March 19, 2015, the London price fix—in place for 96 years—was replaced by the London Bullion Market Association Gold Price, an electronic benchmark administered by the Intercontinental Exchange.
Numerous other developments during the 1970s and 1980s facilitated competitive pricing in commodity markets. Agricultural policies in first world countries gradually become “market friendly” first with the replacement of stock-holding mechanisms by price supports and later by decoupled support mechanisms. Pivotal policy shifts were the 1985 US Farm Bill and the 1992 CAP reform in the European Union (Baffes and Meerman 1998). Market based instrument were introduced in most Second World economies after 1989. Third World economies followed suit, where parastatals in charge of marketing and trade of commodities were dismantled often through structural adjustment programs (Akiyama et al 2003). At a global level, international commodity agreements collapsed (Gilbert 1996). The last ICA, the International Natural Rubber Agreement, fell victim to the East Asian financial crisis and collapsed in December 1999.

Geopolitical events played a key role in transforming the pricing mechanisms in energy markets. The 1973 and 1979 oil crises changed the way in which crude oil was priced after OPEC asserted its influence in the oil market. That transition also affected the pricing mechanisms of the global coal market. On the intellectual front, the development of option pricing (Black and Scholes 1973) increased the use of futures and option instruments. On the regulatory side, the U.S. established the Commodity Futures Trading Commission in 1974, an organization tasked with overseeing the functioning of futures trading activity in the United States. Lastly, the commodity price boom of 2000s, partly a response to strong demand growth by emerging economies, notably China, pushed commodity trading activity to East Asia. In other words, the traditional commodity pricing centers of Chicago, London, and New York are increasingly being replaced by Dalian, Shanghai, and Singapore.

Today, most major commodity markets have benchmarking mechanisms in place. Yet, the transition to global benchmark pricing has not been smooth. Nor it has been the same across all commodity markets. The next section reviews the transition process in four commodity markets: Crude oil, coal, natural gas, and iron ore.
IV. The transition to competitive price benchmarking

1. Crude oil

Crude oil is, perhaps, the most important commodity, after it became the key fuel for the internal combustion engine. Crude oil’s global oil production is valued at nearly US$ 2 trillion in 2016, evaluated at $60/bbl—by comparison, global GDP was US$ 75 trillion. Oil is also significant in geopolitical terms, often identified as the key (real or perceived) cause of military conflicts (Klare 2004). Two thirds of oil output (corresponding to one third of total energy consumption) goes to for transportation. During the past four decades, global oil consumption has grown at a rate remarkably similar to population, implying that, at world level, per capita oil consumption has been constant at slightly over four barrels per annum. Of the 92 million barrels per day (mb/d) produced globally in 2016, the top three producers—Russia, Saudi Arabia, and the United States—accounted for about 13 percent each. Oil is the only commodity with a surviving cartel.9

Prior to 1971, the oil price changed very little (Figure 2). Oil trade was dominated by a few companies—the so-called seven sisters—which bought crude oil from countries which, often, owned the resource base (McNally 2017).10 The structure of the global oil market changed fundamentally in the 1970s, when OPEC countries demanded higher prices from the major oil companies. During the 1973 Yom-Kippur War, an oil embargo was imposed against the United States, and OPEC cut production and quadrupled official prices. Subsequent disruptions in oil supplies following the Iran-Iraq war and the Iranian revolution sent prices

9 OPEC (Organization of Petroleum Exporting Countries) was created at the Baghdad Conference on September 10-14, 1960, by Iran, Iraq, Kuwait, Venezuela, and Saudi Arabia. The five founding members were later joined by nine other Members: Qatar (1961), Indonesia (1962; it suspended its membership from January 2009 to December 2015, rejoined in January 2016 and suspended again in November 2016), Libya (1962), United Arab Emirates (1967), Algeria (1969), Nigeria (1971), Ecuador (1973; it suspended its membership from December 1992 and rejoined in November 2007), Angola (2007), and Gabon (1975; terminated its membership in January 1995 and rejoined in July 2016). Currently OPEC’s membership consists of 13 countries. OPEC’s objective is to “co-ordinate and unify petroleum policies among Member Countries, in order to secure fair and stable prices for petroleum producers; an efficient, economic and regular supply of petroleum to consuming nations; and a fair return on capital to those investing in the industry.” (OPEC 2017).

10 The seven sisters were: (1) Anglo-Persian Oil Company, it became Anglo-Iranian Oil Company, then British Petroleum, and BP after acquiring Amoco and Atlantic Richfield (U.K.); (2) Gulf Oil, which after acquiring Standard Oil of California became Chevron (U.S.); (3) Royal Dutch Shell (Netherlands/U.K.); (4) Standard Oil of California, which became Chevron (U.S.); (5) Standard Oil of New Jersey, became Exxon, then ExxonMobil after acquiring Mobil (U.S.); (6) Standard Oil of New York, which became Mobil (U.S.); (7) Texaco, acquired by Chevron (U.S.).
more than doubling in 1979. OPEC tried to keep prices high by cutting production significantly in the early 1980s, but as financial pressures mounted OPEC chose to reclaim market share and prices plunged in 1986.

The New York Mercantile Exchange introduced the WTI (West Texas Intermediate) oil futures contract in 1983, which became the price benchmark for the mid-continent United States. Shortly thereafter, the Brent contract was launched, often viewed as the world price barometer. Numerous other futures oil contracts have been launched since then. With a few exceptions, oil price benchmarks move together, as expected (Figure 5). Among all commodity markets, oil futures have also the longest horizon (up to 10 years). Although far contracts have less liquidity than nearby contracts, they do provide valuable information through the futures curve slope (Figure 6).

Figure 5: Crude oil price

Source: World Bank
Note: Last observation is August 2017
2. Coal

Coal, the “oldest” fossil fuel, has been used extensively throughout history and was instrumental in ushering the industrial revolution, railroad transport, and iron production during the 18th and 19th centuries. Coal accounts for 30 percent of primary energy needs and generates 40 percent of world’s electricity—thermal (or steam) coal, which accounts for more than 80 percent of global coal consumption is used to produce heat to turn the boiler’s water into steam which spins the turbines of electricity generators. Some coal (called coking or metallurgical coal) goes to smelting iron ore for steel production. Coal use, whose global production is up 70 percent in the past two decades, has been declining recently due to environmental concerns and competition from natural gas. The world’s key coal producers are China which accounts for almost half of global production, followed by the United States (12 percent share) and India and Indonesia (about 7 percent each).\textsuperscript{11} About 15 percent of global coal production is internationally traded. Coal is also considered the most polluting fossil fuel.\textsuperscript{12}

\textsuperscript{11} China’s coal consumption growth during the past two decades resembles England’s growth during late 18th century (which accounted for 60 percent of world consumption) and that of the United States in the early 20th century (which accounted for half of world consumption).

\textsuperscript{12} According to the U.S. Energy Information Administration, coal emits 98 kg of CO\textsubscript{2} per mmbtu, compared to 73 kg for crude oil and 53 kg for natural gas.
Prior to the 1960s, international coal trade was limited, mostly land-based, and regional. West Germany, for example, exported coal to Western Europe while Poland and the USSR supplied Eastern European countries. There was also some land-based trade between the United States and Canada. The only seaborne coal trade was from the United States to Western Europe and Japan. An international steam coal market emerged in the 1960s, following demand by (then) newly industrialized countries, including Japan (whose steel mills began importing coal from Canada and South Africa under long-term contractual arrangements), Korea, and Taiwan. An international market of coal began forming after the quadrupling of oil prices during the 1973 crisis, which made coal competitive in power generation (compared to crude oil.) The tripling of oil prices during the 1979 oil crisis further increasing coal’s competitiveness over oil. Coal’s increasing use for electricity generation was also facilitated by the International Energy Agency (IEA) decision to ban its member countries from building new oil-fired electricity plants.

The first international coal price benchmark was the outcome of negotiations between a leading Australian coal supplier, BHP Billiton, and Japanese power and steel companies. These were fob-based prices for major coal brands—prices for the other coking and steam coal brands were adjusted according to qualities calorific content. In addition to Australia, South Africa became a key player in the coal market. This pricing system ended in the late 1990s, as deregulation proceeded in the Japanese power sector and utility companies started negotiating individually and diversifying their sources. Between 1998 and 2002, a “Reference Price System” was in place, whereby individual utilities followed the lead negotiator’s settlements. Colombia, which became an important player in the coal market, also entered the global coal market.

Today there are three widely used international coal price benchmarks (Figure 7): (i) fob spot at Richards Bay, representing South Africa thermal coal exports; (ii)
fob spot at Newcastle, representing Australian thermal coal exports; (iii) fob spot at Bolivar, representing Colombian thermal coal exports. Numerous other prices are also widely used, including Amsterdam-Rotterdam-Antwerp cif for Northwest Europe, Japanese import cif, as well as domestic U.S. prices (Central Appalachia, Northern Appalachia, Illinois Basin, Powder River Basin, and Uinta Basin). Coal is also traded in several futures exchanges. NYMEX (now CME) began trading coal futures in 2001, followed by the Intercontinental Exchange in Europe, and more recently by other exchanges including Amsterdam and Australia. Yet, coal futures are not very liquid, which is consistent with conclusions by numerous studies that the coal market continues to be weakly integrated (Liu and Geman 2017; Zaklan et al. 2012).

**Figure 7: Coal prices**

![Coal prices chart](image)

*Source: World Bank*

*Note: Last observation is August 2017*

### 3. Natural gas

Production of natural gas—which accounts for a quarter of global energy consumption—has doubled over the past two decades, mostly in response to its environmental qualities (it generates half the emissions per unit of energy compared to coal) but also due to the shale natural gas revolution the United States which reduced its cost production considerably. The world’s largest natural gas producers are the United States (22 percent share), Russia (16 percent), followed by Iran and Qatar (5 percent each).
In contrast to crude oil and coal, natural gas does not have a “world” price benchmark. Instead, it consists of several segmented markets whose prices are independent (Figure 8). The U.S. natural gas market has a mature pricing mechanism with the Henry hub being the most important spot trading center. It also has a liquid a natural gas futures contract, which was launched in the early 1980s. Prices of the other two major markets, European natural gas and LNG (Liquefied Natural Gas) are still linked to oil.

Figure 8: Natural gas prices

However, there has been a gradual delinking of natural gas from oil prices recently (Colombo et al. 2016). There is also as evidence in favor of the so-called “spotification” of the LNG market (see econometric analysis reported in Appendix B). These outcomes are backed by three trends. First, among them is handling the “difficult” nature of natural gas. Because natural gas is unstable in its natural state (gas)—as opposed to oil (liquid) and coal (solid) which are stable—it is costly to store and transport and is also prone to accidents. For example, transportation requires either an extensive pipeline network, or liquefaction and regasification facilities for LNG. Both have problems, geopolitics the former, expensive the latter. But this is changing now with the building of new LNG facilities, both in the United States and elsewhere. Second, the shale revolution, in the United States, increased the recoverable reserves and reduced the production costs of natural gas. Expansion of LNG trade will reduce geopolitical risks (i.e., LNG could act as “insurance” against geopolitically-driven embargoes or as Nakano (2016) put it,
it is the “democratization of LNG”). Third, demand for natural gas is likely to be aided by environmental policies due to its low CO2 emissions.

4. Iron ore

Iron ore is primarily used to produce iron, a key input to steel manufacturing (along with nickel). The world’s key producers of iron ore are Australia (40 percent share), followed by Brazil (21 percent), India (7 percent), and China (6 percent). Consumption is dominated by China, with more than 50 percent share, up from 7 percent two decades ago.

As recently as 2005, iron ore prices were the outcome of negotiations between Vale, Brazil’s largest iron ore producing company and European steel manufacturers—during the 1980s and 1990s, Brazil was the world’s top iron ore producer while Europe, along with the United States and Japan were the largest consumers. Typically, negotiations between Vale and steel manufacturers would begin early in the year and by the second quarter an agreement would be reached on the price benchmark, applicable for the entire year and, sometimes, two years (Vale 2014).

The pricing of the iron ore market changed recently from negotiated to spot pricing (Figure 9). Two key reasons for the move away from the negotiating price mechanism include the emergence of China as the world’s key iron ore consumer and the price increase that began in 2005, which is linked to demand pressures from China. According to Astier (2015) the change in the pricing mechanism was inevitable and it is likely to stay in place.
Figure 9: Iron ore price and metal price index

V. Impediments to (and consequences of) global price benchmarking

1. Impediments to benchmarking

Several interesting lessons can be drawn from the early history and recent developments of competitive pricing. First, both degree and nature of government intervention play a key role in commodity pricing. As noted earlier, policies up to the 1970s virtually eliminated commodity futures markets, the key price benchmarking mechanism. However, the shift in policies (not necessarily the degree of intervention) facilitated the reemergence (in the case of agricultural commodities) and emergence (in the case of industrial commodities) of competitive pricing. The collapse of Bretton Woods also facilitated the emergence of competitive pricing of financial products such as exchange and interest rates.

Second, resource ownership (and, especially, development), has also played a role in competitive price benchmarking. State ownership of resources, which is the case with many industrial commodities such as energy, typically delays the emergence of price benchmarking mechanisms.
Commercial interests play an important role. Important examples are the earlier history of crude oil pricing with “seven sisters” as well the iron ore market the price of which was the outcome of negotiations between one iron ore supplier and a few steel manufacturers. In the former case, crude oil prices were virtually unchanged. Similarly, in the case of iron ore, as can be seen from Figure 8.

Last, the physical characteristics play, perhaps, the most important role. These characteristics include bulky commodities (i.e., commodities with a low price relative to their weight), commodities which are traded in ore stage with various types of energy or metal content (e.g., coal and iron ore), or commodities which are expensive to store and transport (notably natural gas).

2. Consequences of benchmarking: Volatility and financialization

The transition from “managed pricing” to competitive price benchmarking comes with higher volatility. Consider iron ore price. During 1980-2005, iron ore price volatility (defined as the standard deviation returns) was half compared to the base metal price index. Similarly, its price dispersion (defined as the percentage change of the highest over the lower value) was only a quarter of the metal price index. The correlation between iron ore and the base metal price index was low as well. For example, the metal index more than doubled from 1986 to 1988, iron ore prices declined 7 percent. However, both volatility and dispersion were roughly equal during 2005-17. This should not be surprising given that all metals respond to the same set of macroeconomic and sectoral fundamentals (Baffes and Savescu 2014). And, the post-2006 iron ore price volatility is nearly twice as much as that of the metal price index, which is what should be expected given that indices exhibit smaller volatilities due to averaging.

The development of global price benchmarking mechanisms in futures exchanges appears to have pushed the pendulum the opposite way. Indeed, in the aftermath of the commodity price peaks during the post-2000 commodity cycle, several authors, analysts, and politicians noted that “speculation” was the driving force behind commodity price movements. Some also viewed financialization as an impediment to competitive pricing.16

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16 For a literature review on the financialization of commodity markets see Haase et al. (2016) who review the findings of 100 empirical studies.” The rest of Section 5 draws heavily from Baffes and Haniotis (2010).
There are numerous factors behind such increase in commodity assets. From an academic perspective, several authors argued that commodities are becoming an attractive investment vehicle. For example, Rogers (2004, p. 3) began his book with the prediction that “A new bull market is under way, and it is in commodities—the ‘raw materials,’ ‘natural resources,’ ‘hard assets,’ and ‘real things’ that are the essentials of not just your life but the lives of everyone in the world.” Similarly, Heap (2005) in a report entitled “China—The Engine of a Commodities Super Cycle” that focused primarily on copper, argued that China’s high rates of urbanization, industrialization, and capital formation set the stage for a super cycle, similar to the ones experienced during late 1800s and early 1900s (driven by growth in the US) and the post-Second World War (prompted by reconstruction in Europe and the Japanese expansion.) In a somewhat different but conceptually related context, Gordon and Rouwenhorst (2004) challenged the long standing view that commodities are not appropriate investment vehicles due to their downward price tendencies. Based on 45 years of monthly commodity futures prices, they showed that a diversified investment in commodities has a slightly lower risk than equity investments, thus rendering the inclusion of commodities in bond and stock portfolios an effective diversification mechanism.

Second, advancements in information technology along with the replacement of open outcry by electronic trading reduced transactions costs. Third, commodity exchanges, which used to be owned and operated by their members, became public traded entities, thus changing their objective from price discovery and hedging facilitators to profit maximizing entities (for example, CME is traded at NASDAQ while ICE is traded at NYSE). Fourth, ample liquidity due to low interest rates, lowered the returns from certain assets classes, including cash and treasuries, in turn pushing investors to seek higher returns in other asset classes, including commodities. Fifth, U.S. legislation, in particular the Commodity Futures Modernization Act of 2000, allowed investment funds to hold commodity positions as a hedge mechanism. For all these reason, commodity trading activity at futures exchanges increased considerably, including assets under management which grew fivefold from 2002 to 2016 (Figure 10).
What distinguishes the recent debate on speculation is that it has divided even noted scholars and analysts. Apart from the insufficient empirical evidence on the subject, such division partly reflects the different types of “speculative activity” that analysts and economists refer to. Indeed, the lines between hedgers and speculators, between physical and financial transactions, as well as between legal and illegal trading activities are complex. For example, consider the traditional separation of the place in which transactions take place (physical versus financial) and the actors involved (hedgers versus speculators), as depicted in Table 1. The first column shows hedging transactions by producers, consumers, and traders (with the banks as intermediaries) that take place either in physical or financial markets (the latter in commodity futures exchanges). This is the typical text-book case.

The picture becomes complicated, however, when speculators engage in physical transactions by holding inventories, keeping resources in the ground, or engaging in various types of market manipulation. An even more complex picture emerges when speculators engage in financial transactions (often combined with physical transactions). Hence, understanding the complexities and the controversial nature of speculation ultimately comes down to understanding the right-bottom cell of the Table 1. One way to analyze speculation is to map its sources and its effect on commodity markets to the place where transactions take place, the actors involved, and their motivation.
Table 1: “Speculation” in commodity markets

<table>
<thead>
<tr>
<th>PHYSICAL</th>
<th>SPECULATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producers</td>
<td>Holding inventories (e.g., hoarding)</td>
</tr>
<tr>
<td>Consumers</td>
<td>Keeping resources in the ground (e.g., OPEC)</td>
</tr>
<tr>
<td>Traders</td>
<td>Market manipulation (e.g., cornering the market)</td>
</tr>
<tr>
<td>Financial</td>
<td>Investment funds (e.g., pension funds, sovereign wealth funds)</td>
</tr>
<tr>
<td>Traders</td>
<td>Investment and diversification instruments (e.g., CTAs, hedge funds)</td>
</tr>
<tr>
<td>Banks</td>
<td>Market manipulation (e.g., cornering the market)</td>
</tr>
</tbody>
</table>

Source: Baffes and Haniotis (2010)

**Place of transaction:** Commodity transactions take place either in futures exchanges or physical markets. Speculation taking place in commodity exchanges forms the backbone of the functioning of the futures markets by injecting the necessary liquidity to complete the transactions. This is the type of speculative activity that was typically given as a reason for the closure of commodity futures exchanges mentioned above. In the physical market, on the other hand, traders may buy and hold large quantities of commodities with the expectation that an upward movement in prices will generate profits (often called hoarding). Unless such activity entails market manipulation (in which case it would be an illegal activity), it is the intertemporal equivalent of Adam Smith’s “invisible hand”: traders buy at current prices to sell later when (in their opinion) the market will be tight, thereby balancing the market and hence reducing price variability. There is no evidence that hoarding took place during the recent boom, as known inventories in almost all commodities reached historical lows.

**Actors involved:** Apart from the hedgers (e.g., producers and consumers) with interest in the physical transaction of commodities, two other actors have been operating in the market during the last two or so decades with purely financial incentives and no transactions in the physical markets. They are hedge funds and commodity trading advisors (CTAs). During the recent commodity price cycle, investment funds (mostly pension and sovereign wealth funds) also entered the financial markets. It has been argued that these groups (mostly the latter) may have affected commodity prices.

- **Hedge funds.** These undertake investment and trading activities in a broad range of assets, including commodity markets. A hedge fund may trade and invest in commodity asset classes in order to “hedge” the diverse
risks inherent in their portfolios. In such a case, taking a position in the futures market for a commodity or class of commodities can represent an investment in a non-correlated asset that provides diversification benefits to the overall portfolio. Hedge funds have existed for decades and their effect on commodity markets is typically of short term nature.

- **Commodity trading advisors (CTAs)** are asset managers that operate almost exclusively in commodity markets. They invest for portfolios under management and for clients with the objective of earning profits from market volatility. Perhaps, CTA activity reduces price volatility since they trade based on market fundamentals and technical analysis.

- **Investment funds.** They include sovereign wealth and pension funds which during the recent commodity price boom began including commodities in their portfolio mix as another asset class. Their chief motivation has been asset diversification. In addition to the way these funds invest in futures markets (i.e., fixed weights and past performance criteria), it is their sheer size that matters most.

**Motivation:** Very often speculation takes place in the form of market manipulation. This refers to illegal activity typically isolated in one or a few commodity markets. Although it can take place in the physical or financial markets, it often involves both. Well publicized cases are the US onion market in the 1950s, where onion producers argued that traders in the Chicago Mercantile Exchange cornered the market—this resulted in the passage of the Onions Futures Act which prohibited futures contracts on onions (Markham 2002); the Hunt brothers who attempted to corner the silver market in the late 1970s and early 1980s (Eichenwald 1989); Sumitomo’s chief copper trader, Yasuo Hamanaka, who cornered the copper market in the 1990s (Krugman 1996); and the BP cornering of the propane market in 2006, which resulted in a US$ 300 million fine (Till 2008). Such activity is not known to have prevailed during the recent boom.
VI. Concluding remarks

Global commodity price benchmarks influence the price at which most commodity transactions take place. Early commodity pricing benchmarks were developed in the 17th and 18th centuries and included sporadic futures trading in Amsterdam, the Dōjima futures rice market in Japan, and London’s Tea Auction. Competitive benchmark pricing, however, flourished in the late 1800s in two parallel tracks: Grains in Chicago and for cotton in both sides of the Atlantic. The latter was aided by the successful installation of the transatlantic cable in 1865, which rendered cotton a global market by linking five futures exchanges in the 1880s.

The global competitive pricing benchmarking, however, suffered from post-depression protective trade policies, which were followed by post-WWII policies, including the Bretton Woods arrangement, absence of pricing mechanisms in centrally planned economies, proliferation of International Commodity Agreements (ICAs), commodity subsidization by OECD countries, and industrialization policies by developing countries. These policies were often complemented (and facilitated) by strong commercial interests. Competitive pricing reemerged after the collapse of Bretton Woods with the introduction of financial derivatives, market-friendly policies in both OECD and developing countries, the shift to market-orientation of centrally planned economies, and the collapse of ICAs.

Today, most commodities are priced in a competitive manner; the ones that are not, reflect mostly physical characteristics rather than policy impediments. Notwithstanding this achievement, a new issue has emerged—the financialization of commodities. While some view financialization a major impediment to competitive pricing, other consider it the zenith of competitive pricing.
APPENDIX A

INTERNATIONAL COMMUNICATIONS AND THE TRANSATLANTIC CABLE

The first attempt to connect the Old and the New World by cable was made in 1854 with a proposed land link designed to pass through Alaska, cross the 100 miles of shallow water at the Bering Straits, and then reach England through Siberia and Eastern Europe. While this link was under consideration, another attempt to connect the United States and England through the Atlantic Ocean was undertaken in 1857 with the installation of the transatlantic cable. The cost of installing that cable reached $US 4.2 million (4,200 kilometers at $1,000 per kilometer). This cable never transmitted a single message. A second attempt was undertaken a year later but the cable transmitted messages for only three weeks; the cable then failed irreparably. The rate of transmission of the second cable was three 5-letter words per minute. The exact number of messages that were sent through the 1858 cable is unknown, sources place it between 271 and 732 words at $10 per 5-letter word, equivalent to 73 kilograms of cotton at 1858 prices. The failure of these cables reflected inadequate understanding of transmission than poor insulation or armoring.

Despite strong demand for message transmission, raising capital to invest in a third attempt was difficult, especially in the United States which was preoccupied with the civil war. However, the British textile industry soon realized the benefits of instantaneous communication and provided financing for another cable. Initially, the land link through Siberia was reconsidered briefly but did not materialize due to high costs and geopolitical risks. The first two successful transatlantic cables were installed in 1865 and 1866 by John Pender, a textile merchant from Manchester who had formed a telecommunications company in 1864. These cables were operated by the Anglo-American Telegraph Company—a spin-off of Pendor’s company—which dominated global communications for the remainder of the nineteenth century.

On the technical side, the success of these two cables reflected application of Maxwell’s 1864 theory of electrodynamics as well as better knowledge of the ocean floor. The transmission speeds of these cables were initially 8 words per minute but soon reached 16 words per minute. A third (identical) cable was

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17 This Appendix draws from Baffes (2005), Hugill (1999), and Wenzlhuemer (2013).
installed in 1869 by a French company, also financed by British investors. The lifespan of these cables was not long: The 1866 cable failed irretrievably in 1872, the 1865 one in 1877, and the 1869 French cable in 1894.

The short lifespan of the early cables ushered the next generation of more efficient cables with the Anglo-American Telegraph Company installing two cables in 1873 and 1874. The United States entered the global communications sector with Siemens installing the first cable in 1875. Like all other cables, the 1875 cable transmitted 16 words per minute. Information technology advances in 1878, enabled the 1875 cable to transmit messages simultaneously in both directions, thereby increasing transmission capacity to 32 words per minute. Siemens installed two more cables in 1881 and 1882 using the duplex technology.

A number of heavier duty lines were installed between 1894 and 1910 increasing the rate of transmission to 50 words per minute. Finally, the “modern” generation of cables in the 1920s saw further increases in transmission capacity, from 2 x 50 words per minute to 5 x 60 in 1924, 4 x 80 in 1926, and 5 x 50 in 1928. These improvements pushed transmission costs from $10 per word in 1872 to $5 in 1873, reaching 50¢ in 1884 and 25¢ in 1888. The latter was equivalent to 2.5 kgs of cotton at 1888 prices, down from 73 kgs three decades earlier. Thus, with 2.5 kgs worth of cotton, traders at the New York Cotton Exchange could acquire information on the closing futures price at Liverpool.

Apart from the transatlantic cables, numerous other cables were installed towards the end of the 19th century. The Indo-European Telegraph company linked England with India in 1865, but the transmission of messages was expensive and slow. Moreover, the handling of messages by people with poor command of the English language imposed another impediment. Pender’s company laid the Malta-to-Alexandria cable in 1868 and shortly thereafter connected England to Malta. By 1872 a cable reached Australasia while by the mid-1880s connections were extended to East Africa including Mauritius (through Zanzibar).
APPENDIX B

OIL AND NATURAL GAS PRICING

To understand and analyze the salient features of oil and natural gas pricing, we apply the following econometric specifications. First, an error-correction model (ECM) examines the relationship between Brent and WTI prices during the shale revolution period and compares it with earlier periods. Second, an OLS regression examines indexation of Natural gas (Europe) and LNG (Japan) prices to crude oil. Third, an ECM examines the relationship between LNG (Japan) and an emerging Spot (Asia) price.

B1. Oil price comovement during the US shale oil revolution

The global oil markets has been well integrated since the 1980s (Adelman 1984; Saur 1994). The rest of this section examines whether the link between U.S. (WTI) and world (Brent) oil prices weakened during the shale revolution. To examine such relationship, we apply the following error-correction specification:

\[ \Delta p_t = \beta_0 + \beta_1 (p_{t-1}^{Brent} - p_{t-1}^i) + \beta_2 \Delta p_t^{Brent} + \text{lags}(\Delta p_t, \Delta p_t^{Brent}) + \varepsilon_t \]

where \( p_t^i \) denotes the (logarithmic) of WTI and Dubai price and \( p_t^{Brent} \) denote Brent prices. The \( \beta_i \)'s are parameters to be estimated, \( \Delta \) denotes the first difference operator, and \( \varepsilon_t \) represents the error term. The lags ensure that the error term is a white noise. We impose the unitary restriction in the cointegration parameter, which is why there is no coefficient before \( p_{t-1}^{Brent} \) in the parenthesis (Hendry, Pagan, and Sargan 1984). The unitary cointegration restriction implies that prices will converge in the long run and is equivalent to establishing stationarity of the price differential or ensuring that \( \beta_1 \) is significantly different from zero—this follows the Engle and Granger representation theorem (Engle and Granger 1987); see Baffes (1991) and Baffes and Gardner (2003) for empirical application with unity cointegration parameter. Also, to ensure that \( \varepsilon_t \) is white noise, we append one lag to both prices. To facilitate a proper comparison, we use two samples of equal size. The shale boom period spans March 2009 to March 2017 (latest available data point), 96 monthly observations. The pre-shale boom period, spans January 1997 to March 2004, also 96 observations. Our intention was to exclude the post-2016 price spike, which was characterized by elevated price volatility. We also report results for the entire sample, January 1992 to March 2017, 422 observations.
Results are reported in table B1, WTI in the upper panel and Dubai in the lower panel. In the two periods under consideration, the gap between the two prices went from a WTI-premium over Brent of $2/bbl (6 percent) 2001:01-2005:12 to an $11/bbl discount (-11 percent) during the shale boom period (Figures B1 and B2). The ECM results show that the adjusted-R² declined marginally from 0.91 in the earlier period to 0.80 during the shale boom period. And, although adjustment effect halved (from 0.41 to 0.19), the contemporaneous impact increased. These parameter estimates were robust to the specification with one additional lag. Indeed, the results confirm that the relationship between the two prices weakened only marginally, implying that the “law of one price” held remarkably well during the shale boom.

As a robustness check, the ECM regression was applied to the entire period (1989-2007) with a 90-month window rolling regression for both WTI-Brent and Dubai-Brent. Results of the adjustment R-squares and the adjustment parameter estimates are depicted in Figures B3 and B4, respectively. Indeed, both R-square and adjustment coefficient declined when the observations subjected to the shale boom were included in the sample. However, as the window moved, the adjustment coefficient increased, confirming that the shale boom affected the global pricing benchmarking relationship only temporarily.

B2. Natural gas and NLG indexation to oil

To understand the indexation of the European and LNG prices to oil, the following OLS regression is specified:

\[ p_{t}^{NG} = \beta_0 + \beta_1 p_{t-i}^{OIL} + \epsilon_t \]

where \( p_{t}^{NG} \) denotes the (logarithmic) price of Natural gas (Europe) and LNG (Japan), \( p_{t-i}^{OIL} \) denotes the \( i \)th lag of oil price, approximated by three benchmarks (Brent, WTI, and Dubai), \( \beta_0 \) and \( \beta_1 \) are parameters to be estimated, \( \epsilon_t \) and represents the error term. The sample, which consists of 446 monthly observations (1980:01-2017:02), was divided in three periods: (i) up to the year when prices changed from annual to monthly adjustment, 1990 for Natural gas (Europe) and 1991 for LNG (Japan); (ii) until the end of 2006, which marks the price boom (and also the emergence of the U.S. natural gas shale revolution); and (iii) until February 2017, the latest available observation.

Results are reported in Table B2, Natural gas (Europe) in the left panel and
LNG (Japan) in the right panel. A number of important results emerge from the analysis. First, based on up to a 6-lag structure (i.e., i = 1, ...6) for all three oil benchmarks, both LNG (Japan) and Natural Gas (Europe) prices are best explained by the fifth lag of Brent. This conclusion reflects conventional ($R^2$ and t-statistics) and three stationarity tests (similar to the statistics reported in table B2).

Second, the gas-brent relationship for both Europe and NLG prices is much stronger in the second period than the first, confirmed by a higher $R^2$ and cointegration statistics. This should not be surprising given the nature of the pricing mechanism in these two periods—annual adjustment in the former vis-a-vis monthly adjustment in the latter.

Third, the price link between Natural Gas (Europe) and Brent weakened in the third period, according to both conventional and cointegration statistics—the adjusted $R^2$ declines from 0.93 to 0.86 and two of the three cointegration statistics decline as well. The weakening is evident in Figure B2 where Natural gas (Europe) has been traded at a considerable lower level than Brent after 2008, which, not coincidentally, was the time when the natural gas shale revolution created a glut in the U.S. natural gas market. Interestingly, natural gas in the U.S. was, perhaps, the only commodity price, which did not increase after the great recession.

Fourth, there is evidence (albeit weak) that the LNG (Japan)-Brent price link may be weakening as well. Although this is not evident in Figure B1, all three cointegration statistics are lower in the third period (compared to the second); the $R^2$ is lower as well—it declined from 0.94 to 0.89. These findings, are consistent with weakening of oil indexation.

**B3. LNG spotification**

To further examine the likely weakening of natural gas price indexation to oil, we apply the following ECM between LNG (Japan) and the emerging Spot (Asian) prices (Figure B2).

$$\Delta p_t^j = \beta_0 + \beta_1(p_t^j - p_{t-1}^j) + \beta_2 \Delta p_t^j + lags(\Delta p_t^j, \Delta p_t^l) + \epsilon_t$$

where $p_t^j$ and $p_t^l$ denote the logarithm of LNG (Japan) and Spot (Asia) price. The notation and interpretation of the parameters is the same as in the ECM specification of section B1.
Parameter estimates of the ECM model, which was estimated in both directions, are reported in Table B3—LNG (Japan) is the dependent variable in the left panel and Natural gas (Europe) is the dependent variable in the right panel. The first column reports the ECM parameter estimates without lags. The error-correction estimate, 0.17, is significant at the 1 percent level, implying that there is long run convergence between the two prices. The parameter estimate of the contemporaneous impact is 0.14. These estimates imply that following any shock originating from the spot markets, 14 percent will be transmitted immediately and the 17 percent will be eliminated in each subsequent period. The second and third columns include lags of first differences but without the contemporaneous effect to ensure that no common factors are influencing prices. In both cases, the error correction term remains significant, confirming that Asia (spot) Granger-causes LNG (Japan).18 The next three columns report results in the opposite direction to examine if LNG (Japan) Granger-causes Asia (spot). In all three regressions, the parameter estimate of the error-correction term is not significantly different from zero, imply no reverse causation.

The strength between LNG (Japan) and Spot (Asia) prices, the Granger causality pattern, and the post-2007 weakening of oil indexation confirmed earlier, are indeed consistent with changing patterns in natural gas pricing. These findings can also be interpreted as early signs of pricing mechanisms that are replacing oil indexation, and, perhaps, the formation of a world natural gas barometer (albeit with a large difference between LNG and other prices due to high production and transportation costs of the former).

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18 The presence of cointegration—confirmed by the fact that error-correction term is significantly different from zero in at least one direction—implies Granger- causality, in the same direction (Engle and Granger 1987).
### Table B1: ECM parameter estimates of crude oil price relationship

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WTI-Brent price relationship (WTI is the dependent variable)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_0$</td>
<td>0.00 (1.21)</td>
<td>0.01 (1.10)</td>
<td>0.02*** (4.09)</td>
</tr>
<tr>
<td>$p_{t-1}^{Brent} - p_{t-1}^{WTI}$</td>
<td>0.08*** (4.11)</td>
<td>0.08*** (4.24)</td>
<td>0.29*** (4.33)</td>
</tr>
<tr>
<td>$\Delta p_t^{Brent}$</td>
<td>0.87*** (51.45)</td>
<td>0.86*** (50.00)</td>
<td>0.81*** (29.26)</td>
</tr>
<tr>
<td>$\Delta p_{t-1}^{WTI}$</td>
<td>—</td>
<td>0.10*** (2.08)</td>
<td>—</td>
</tr>
<tr>
<td>$\Delta p_{t-1}^{Brent}$</td>
<td>—</td>
<td>-0.4 (0.83)</td>
<td>0.17* (2.09)</td>
</tr>
<tr>
<td>$R^2 - Adj$</td>
<td>0.86</td>
<td>0.87</td>
<td>0.90</td>
</tr>
</tbody>
</table>

| **Dubai-Brent price relationship (Dubai is the dependent variable)** | | | |
| $\beta_0$ | -0.01*** (4.13) | -0.01*** (4.23) | -0.01** (2.15) |
| $p_{t-1}^{Brent} - p_{t-1}^{Dubai}$ | 0.12*** (5.20) | 0.13*** (5.23) | 0.17*** (2.74) |
| $\Delta p_t^{Brent}$ | 0.98*** (69.32) | 0.96*** (67.12) | 0.85*** (26.60) |
| $\Delta p_{t-1}^{Dubai}$ | — | 0.03 (0.63) | 0.25** (2.32) |
| $\Delta p_{t-1}^{Brent}$ | — | 0.03 (0.62) | -0.14 (1.43) |
| $R^2 - Adj$ | 0.92 | 0.92 | 0.88 |

Notes: Prices are expressed in logarithmic terms. The numbers in parentheses are absolute t-statistics. Asterisks (*, **, ***) denote significant levels at 10, 5, and 1 percent. A hyphen, “—”, implies that the variable was not included in the regression.
Table B2: OLS parameter estimates of the natural gas-crude oil price relationship

<table>
<thead>
<tr>
<th>Natural gas (Europe)</th>
<th>LNG (Japan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_0$</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>(2.20)</td>
</tr>
<tr>
<td>$\rho_{t-5}^{Brent}$</td>
<td>0.17***</td>
</tr>
<tr>
<td></td>
<td>(5.09)</td>
</tr>
<tr>
<td>$R^2 - Adj$</td>
<td>0.31</td>
</tr>
<tr>
<td>ADF</td>
<td>-3.05**</td>
</tr>
<tr>
<td>PP</td>
<td>-3.48***</td>
</tr>
<tr>
<td>DF-GLS</td>
<td>-2.58**</td>
</tr>
</tbody>
</table>

Notes: Number in parentheses are absolute t-statistics. Asterisks (*, **, ***) indicate parameter estimates and stationarity statistics significant at the 10, 5, and 1 percent levels. ADF, PP, and DF-GLS are the augmented Dickey-Fuller, Phillips-Perron, and Dickey-Fuller GLS unit root statistics. The last observation is March 2017.

Table B3: ECM parameter estimates of LNG (Japan)-Asia (spot) price relationship

<table>
<thead>
<tr>
<th>$\beta_0$</th>
<th>i = LNG (Japan), j = Asia (spot)</th>
<th>i = Asia (spot), j = LNG (Japan)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.02*</td>
<td>0.02***</td>
</tr>
<tr>
<td></td>
<td>(2.20)</td>
<td>(2.75)</td>
</tr>
<tr>
<td>$p_{t-1} - p_{t-1}^i$</td>
<td>0.17***</td>
<td>0.19***</td>
</tr>
<tr>
<td></td>
<td>(5.09)</td>
<td>(4.58)</td>
</tr>
<tr>
<td>$\Delta p_{t}^i$</td>
<td>0.14**</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>(2.25)</td>
<td></td>
</tr>
<tr>
<td>$\Delta p_{t-1}$</td>
<td>—</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>(1.41)</td>
<td>(1.50)</td>
</tr>
<tr>
<td>$\Delta p_{t-1}^i$</td>
<td>—</td>
<td>-0.10</td>
</tr>
<tr>
<td></td>
<td>(1.31)</td>
<td>(1.58)</td>
</tr>
<tr>
<td>$\Delta p_{t-2}$</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>(0.15)</td>
<td></td>
</tr>
<tr>
<td>$\Delta p_{t-2}^i$</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>(2.22)</td>
<td></td>
</tr>
<tr>
<td>$R^2 - Adj$</td>
<td>0.31</td>
<td>0.28</td>
</tr>
<tr>
<td>Observations</td>
<td>71</td>
<td>70</td>
</tr>
</tbody>
</table>

Notes: Japan (import) price is the dependent variable in the first three columns and Asia (spot) price is the dependent variable in the last three columns. Prices are expressed in logarithmic terms. The numbers in parentheses are absolute t-statistics. Asterisks (*, **, ***) denote significant levels at 10, 5, and 1 percent. A hyphen, “—”, means that the variable was not included in the regression.
Figure B1: WTI-Brent price differential

Source: World Bank
Note: WTI premium (+)/discount (-) compared to Brent. First and last observations are January 1882 and May 2017.

Figure B2: Brent-Dubai price differential

Source: World Bank
Note: Brent premium (+)/discount (-) compared to Dubai. First and last observations are January 182 and May 2017.
Figure B3: The WTI-Brent and Dubai-Brent links—R-squares

Source: World Bank
Note: Each data point represents the R-squared from a 96-month regression (8 years), represented as a trailing window.

Figure B4: The WTI-Brent and Dubai-Brent links—adjustment coefficients

Source: World Bank
Note: Each data point represents the adjustment coefficient from a 96-month regression (8 years), represented as a trailing window.
Figure B5: Natural gas and (lagged) Brent oil prices

Source: World Bank
Note: Last observation is August 2017.

Figure B6: LNG (Japan) and Spot (Asia) prices

Source: World Bank and World Gas Intelligence.
Note: Last observation is August 2017.
References


PART II

THE IMPACT OF FINANCIALIZATION ON COMMODITY MARKETS AND INDUSTRIES
CHAPTER 3

Benefits and Disadvantages of Commodity Financialization: Selected Agricultural Market Experiences

Luciano Gutierrez

I. Introduction

The agricultural commodity prices have registered extreme fluctuations in the past decade, starting from the shocking boom-and-burst of 2007 – 2008 and followed by a second new wave during the 2010-2011 years. Moreover, commodity prices have also been extremely volatile, with apparently no clear link to changes in market fundamentals. The price dynamics have stimulated a relevant debate on the causes of the commodity price behaviour, especially through the possible role exerted by the so-called financialization of the commodity markets. This term refers to the role exerted by the financial investors, particularly the so-called index traders, who have increasingly treated commodities as an alternative asset class to optimize the risk-return profile of their portfolios.

However, it is not simple to ascribe the effective role of financialization in the determining of the recent dynamics of commodity prices. A wide variety of factors, in the same period, could have altered the behavior of prices. Focusing only on the factors often cited as main determinants of prices fluctuations, we can include the growing food demand in developing countries, the lower production growth rate, or weather events (Von Braun, 2007; Dewbre et al., 2008; Trostle, 2008; Krugman, 2011). Commodity prices are more volatile than other prices in the economy because both global supply and demand for commodities are relatively price inelastic, especially in the short term. In developing countries, the food and nutrition situation has changed dramatically among the middle-income groups with a process of change of food habits and consumption patterns.
The change is primarily found in carbohydrate-rich staples to vegetable oils and animal products, meat and dairy foods. As the demand of animal products rises, demand for the grain and protein feeds used to produce meat and dairy foods also increases. Moreover, world cattle production has turned toward more intensive feeding systems, which use more grain and protein meal (Trostle et al. 2011). As increasing the level of production of new feedstuffs takes time, the results in the short term can positively influence the price of food commodities such as maize or soybeans.

Some authors have stressed that especially for maize and soybeans, increased biofuels production offers a strong explanation of rapidly increasing prices across a number of different commodities, especially when we consider substitution effects (see Headey and Fan, 2008; Mitchell, 2008). The demand of maize for ethanol grew rapidly from 2004 to 2007, and the ethanol industry used 70% of the increase in global maize production over that period. Further causes have been identified in the decline of commodity stocks in the pre-boom period, the weak US dollar (Abbott, Hurt and Tyner, 2008; Piesse and Thirtle, 2009), the cost of transport and in the increase of the energy prices (Baffes and Haniotis, 2010), which influences the cost of inputs in the agricultural sector such as nitrogen fertilizers.

Alongside with the previous factors, an explanation widely discussed is the rapid increase of derivatives trading and financial investor activity in commodity markets, including the agricultural markets. This phenomenon has given rise to considerable interest in the possible role exerted by the growing financial investors and, above all, on the relative weight that should be attributed to financialization of the commodity markets in possible adverse effect on commodity markets over the recent time periods (Cooke and Robles 2009; Gilbert, 2010; Irwin, Sanders and Merrin, 2010; Sanders, Irwin and Merrin, 2010).

One of important benefits associated to financial markets is that they let consumers and producers hedge their exposures to fluctuations in commodity prices, allowing to manage the uncertainty about future price movements. If the decisions of financial speculators are induced by informed views about fundamentals, financialization mitigates the hedging pressure and improves risk sharing. Otherwise, if financial investors base their decisions on expectations of future price changes in the absence of fundamental reasons their activities could be destabilising. After 2002-2004, an increasing presence of Commodity Index Traders (CIT) has been registered in the derivative commodity markets, both at
the exchanges and over the counter (OTC). Index investors usually operate with a strategic portfolio allocation between the commodity class and other asset classes, as stocks, bonds, real estate and emerging market assets, Tang and Xiong (2012). CITs and other large institutional traders have been accused of exerting a destabilizing influence on commodity prices. Criticisms over the increasing presence of CITs are connected to their portfolio rebalancing which can introduce price volatility coming from outside markets into and across the commodity markets. The higher volatility can imply welfare losses for higher uncertainty and affect consumers and producers once translated into spot markets. However, different studies state that CITs had no impact on price changes across the commodity markets. Sander et al. (2010), among others, assert that the new demand of futures contracts generated by CITs always finds the new supply. Thus, the larger amount of money flowing into the commodity markets does not necessarily impact prices. Further, because CITs do not participate in the futures delivery process or in the cash market where long-term equilibrium prices are discovered, they cannot influence the spot markets.

In this study, we focus on the possible benefits and disadvantages coming from the financialization of agricultural commodity market. Among the benefits, the presence of new investors can lead to more efficient sharing of commodity price risk as well as improve liquidity for a commodity market. On the other hand, it could be argued that their progressive involvement can result in increased volatility across different type of commodities.

Using a vector autoregressive (VAR) model, we investigate, through a simple test procedure proposed by Breitung and Candelon (2006), whether the financialization measures have short- and long-run power in predicting wheat, maize and soybeans spot prices. Differently from standard Granger non-causality analysis which is done in the time-domain, our analysis is conducted in the frequency-domain, which allows to investigate first the causality link and secondly which specific frequency is significantly (or not) involved. Thus, through this framework it is simple to investigate whether the causal effects vary between different cycles, where each cyclical component corresponds to a certain frequency of oscillation. Moreover, the study allows to consider both fundamentals-based drivers and financial market–based factors in price changes.

From the study we find that, after controlling for other variables, financialization has an impact on maize, wheat and soybeans spot prices. Although commodity financialization can improve market liquidity in the futures market, the trading
of financial traders may introduce non-fundamental information and unrelated noise into the futures prices. If this is the case, the historical role of futures markets devoted to price risks and control costs between commodity farmers and manufacturers may be compromised. Commercial traders complain that the commodity markets have been invaded by non-commercial financial firms who have little knowledge of actual market conditions and many politicians lament that the activities of these financial actors can take prices away from their fundamental values.

The conclusion is that financialization has amplified food price movement. We cannot compute the precise impact of financialization on food prices and its total weight remains disputed. However, we find that the effect is not negligible. Governments intervention, domestically and/or through multilateral mechanisms, to introduce more transparency and regulation in these markets, as the Dodd-Frank act, are welcomed.

II. Financialization of commodity price formation

The term financialization has been utilized in the recent years to picture the increasing role of financial investors and financial motives in the arena of commodity future contracts. The investors have been entering in the commodity markets with the aim to diversify their portfolio.

From the side of financial investors, Gorton and Rouwenhorst (2006) have empirically shown many benefits coming from the recent interest on commodity future contracts. First, they have evidenced that the returns on commodities are less volatile than those on equities or bonds. Thus, they are more attractive to market participants that have a low risk profile. Secondly, commodity returns over the business cycle are negatively correlated with the previous assets. This suggests that commodity futures are effective in diversifying equity and bond portfolios. Thirdly, commodity futures contracts also have good hedging properties against inflation because the prices of energy and food products enter in any products basket used to track inflation. Thus, the rise and fall of these commodity prices will be in line with deviations from expected inflation, UNCTAD (2011). Finally, investing in commodity futures contracts may provide a hedge against changes in the exchange rate of the dollar given the negative correlation of commodity prices and US dollar.
One of the main instruments created to fulfill the request of commodity futures contracts are commodity indexes such as the Standard and Poor’s Goldman Sachs Commodity Index (SPGSCI) and the Dow Jones-Union of Bank of Switzerland Commodity Index (DJ-USBSCI). Both indexes are composite of future contracts and include commodities such as energy products, agricultural products and metals. As for the SPGSCI index, it contains different food commodity futures contracts, such as wheat (Chicago Board of Trades, CBOT and Kansas Board of Trades, KBT), maize (CBOT), and soybeans (CBOT). The weight of previous grains in the index varies during the time and in 2017 it amounts to 14.26% weight. Financial investment in commodity indexes involves only long positions and no physical ownership of commodities is involved at any time. This process – labelled as ‘rolling’ – gives rise to a roll yield which is positive in a backwardated market and negative in a contango market. Differently from commodity index, other more recent instruments, the so-called exchange-traded products (ETP), replicate the return of a single commodity or a small group of commodities and the shares are traded in the equity market. These instruments are also available for grain products.

Among the considerable categories of market participants two are reported in the Commitment of Traders (COT) reports published weekly by the U.S. Commodity Futures Trading Commission. The report includes the commercial (i.e. those that use futures contracts for hedging in order to reduce risk in the conduct of a commercial enterprise) and non-commercial (i.e. those that do not hedge). However, commodity also swap dealers, who hedge to offset financial positions fall in the category of commercial even though they would be better categorized as non-commercial. To consider this type of problem the CFTC introduced in 2007 the Commodity Index Traders (CIT), which reports data on position of index traders for twelve agricultural commodities. The index trader positions include those taken by both pension funds, previously classified as non-commercial traders, and swap dealers that had been classified as commercial traders.

The financialization of commodity futures trading has introduced the idea that it may have altered the functioning of commodity exchanges. One of the main benefits associated to the commodity futures trading is connected to the function of facilitating the price discovery and allowing the transfer of risk from producers and consumers to other agents that are prepared to assume the price risk. However, the financialization may have affected this function by altering the traditional commodity supply and demand relationships. As a result, commodity
prices do not reflect changes in fundamentals and are subject to the influences of financial markets. The result is that commodity market participants now have to deal with greater uncertainty regarding the signals coming from commodity exchanges. In this situation, managing the risk it is more complex and expensive and therefore this discourages long-term hedging by commercial users.

Many studies have attempted to quantify the impact of financialization on commodity prices, including food commodity prices. However, since the growth of investments on future contracts increased in the same period as the rise of the demand of physical commodity from the developing economies, it was not simple to distinguish between the two phenomena. The rising demand of the developing countries was not the only fact that characterized the boom (and burst) period of the commodity prices. Although numerous factors have been proposed in the literature to explain recent commodity price movements, there is no consensus on the relative weight that should be attributed to each of them. Many authors have stressed that more consideration should be given to the effects of growing food demand in developing countries, especially in China and India, and to the lower production growth rate as being among the causes of the recent food price spike (see for example Von Braun, 2007; Dewbre et al., 2008; Trostle, 2008; Krugman, 2011). Other studies have argued that biofuel programmes in the United States and European Union are behind the run-up in food prices. These programmes provide subsidies for biofuels leading to a greater use of corn and vegetable oil and resulting in price increases for these commodities (see Headey and Fan, 2008; Mitchell, 2008). On the other hand, Baffes and Haniotis (2010) suggested that the link between food prices and energy prices is the main factor in recent commodity price movements. Energy prices affect food commodity prices by influencing the cost of inputs, such as nitrogen fertiliser, and the cost of transport. The use of agricultural commodities to produce biofuels is also an additional reason for a possible link between energy and food commodity prices. Besides the above-mentioned factors, the list of possible causes analysed in the recent literature also includes the decline of commodity stocks (Abbott, Hurt and Tyner, 2008; Piesse and Thirtle, 2009), a weak US dollar (Abbott, Hurt and Tyner, 2008; Mitchell, 2008), panic buying (Timmer, 2009), bans on exports (Dollive, 2008; Headey, 2011) and, above all, financialization (Cooke and Robles 2009; Gilbert, 2010; Irwin, Sanders and Merrin, 2010; Sanders, Irwin and Merrin, 2010; Gutierrez, 2013).

Focusing on papers which address the theme related to the importance of financialization in determining commodity price boom and burst, an often-quoted paper is that by Tang and Xiong (2010). They analyse a group of commodities,
which include food commodities, with active futures contracts traded in the United States. They conclude that after considering for supply and demand factors, financialization continues to be relevant during the commodity prices boom and burst 2007-2008 cycle. Thus, because of the financialization process, the price of a commodity is determined by the demand and supply of financial assets, and the behaviour of commodity index investors can affect the fundamental side of price determination. Gilbert (2010) addresses the same subject considering the effects of index investment on commodity futures prices. He employed a standard econometric methodology in testing for the effects of index investment on commodity prices. Specifically, Granger noncausality test analysis was used to relate returns on futures contracts to changes in the positions of index investors for the period January 2006 - March 2009. Among the group of commodity prices analysed, maize, soybeans and wheat have been investigated. The results are that index traders Granger-cause the dynamics of maize and not of wheat and soybeans prices. Gilbert's (2010) conclusion is that during the first half of 2008 “… it would be incorrect to argue that high oil, metals and grains prices were driven by index-based investment but index investors do appear to have amplified fundamentally-driven price movements.”

Different criticisms have been advanced to the conclusion that financial investors in commodities, including food commodities, have significantly altered price dynamics. Many factors suggest that, at least for most commodities, the effect has been small. The first appealing criticism is that the price increase for commodities that do not have well-developed financial markets has been as large as that for commodities which are actively traded in financial markets. This may encourage propositions that fundamentals as demand or supply constraints remain the dominant factor determining commodity prices. Secondly, the increase in correlation among commodity prices and the price of financial assets – which has been cited, as we have seen, as one of the facts to support the impact of financial speculators – is not new, but similar episodes have been registered during period of the Great Depression or at the end of 1970s. Assets and commodity prices tend to move together more closely when they are affected by common shocks as during the years 2007-2008 and 2010-2011. Thirdly, Krugman (2001) underlined that we would expect strong changes in commodity inventory during the periods of boom and burst of commodity prices, but these changes have not been registered.

In the following section, we provide new evidence regarding the importance of financialization in determining price movements of spot prices as maize, wheat
and soybeans. Results from test for causality in the frequency domain as proposed by Breitung and Candelon (2006) are presented.

III. Methodology

Suppose that the two-dimensional vector $[x_t, y_t]$ is stationary and can be written as a finite-order Vector Autoregression of order $P$

$$\theta(L)\begin{pmatrix} y_t \\ x_t \end{pmatrix} = \begin{pmatrix} \theta_{11}(L) & \theta_{12}(L) \\ \theta_{21}(L) & \theta_{22}(L) \end{pmatrix}\begin{pmatrix} y_{t-1} \\ x_{t-1} \end{pmatrix} + \begin{pmatrix} u_t \\ v_t \end{pmatrix}$$

(1)

where $\theta(L) = (\theta_0 - \theta_1 L - \theta_2 L^2 - \ldots - \theta_p L^p)$ is a $(2 \times 2)$ lag polynomial and $\theta_0, \theta_1, \theta_2, \ldots, \theta_p$, are autoregressive polynomial matrices and $L^i$ is the lag operator for which $L^i z_t = z_{t-i}$. The error vector $[u_t, v_t]$ is $iid(0, \Sigma)$ with $\Sigma$ positive definite. It is useful to represent the AR process as an MA process,

$$\begin{pmatrix} y_t \\ x_t \end{pmatrix} = \begin{pmatrix} \psi_{11}(L) & \psi_{12}(L) \\ \psi_{21}(L) & \psi_{22}(L) \end{pmatrix}\begin{pmatrix} \varepsilon_t \\ \eta_t \end{pmatrix}$$

(2)

Let $G$ the lower triangular Cholesky matrix for which $GG = \Sigma^{-1}$. We have that $E[\varepsilon_t, \eta_t] = G[u_t, v_t]$. Geweke (1982) suggests a measure of causality in the frequency domain given by

$$M_{x \rightarrow y} = \log \left[ 1 + \frac{|\psi_{12}(e^{-i\lambda})|^2}{|\psi_{11}(e^{-i\lambda})|^2} \right].$$

(3)

When $|\psi_{12}(e^{-i\lambda})| = 0$, $X_t$ does not Granger cause $Y_t$ at frequency $\lambda$. Breitung and Candelon (2006) show that Geweke’s (1982) condition can be expressed as

$$|\theta_{12}(e^{-i\lambda})| = \sum_{k=1}^{p} \theta_{12,1} \cos(k\lambda) - i\sum_{k=1}^{p} \theta_{12,2} \sin(k\lambda) = 0.$$

(4)

From (4) we can note that no Granger causality imply the set of conditions

$$\begin{cases} 
\sum_{k=1}^{p} \theta_{12,1} \cos(k\lambda) = 0 \\
\sum_{k=1}^{p} \theta_{12,2} \sin(k\lambda) = 0 
\end{cases}$$

(5)

Having estimated the coefficients in the first regression of VAR (1), we

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19 We present the bivariate case. The model can be easily enlarged to a multivariate model.
can apply the set of linear restrictions in (5) and performing a standard F-test, $F(2, T - 2p)$ with $T$ the length of the time series and for every $\lambda \in (0, \pi)$.

We studied graphical representations of the test applied on differenced data for a grid of 100 equidistant frequency points in the frequency interval $(0, \pi)$. The Breitung and Caldelon (2006) test is performed for every frequency individually. For indicators that exhibit Granger causality, we should expect results with values of the test above the critical value.

IV. Data

We focused the analysis on the main cereals maize, wheat and soybeans. The data analysis covers the marketing year periods July 2000 - June 2016. Their nominal prices have been collected from the World Bank Database, Commodity Prices Pink Sheet. The oil price has been extracted from the same database and refers to the crude oil average price. We used nominal prices defined as for maize: US, no. 2, yellow, f.o.b. US Gulf ports; for wheat: US, no. 1, hard red winter, ordinary protein, export price delivered at the US Gulf port for prompt or 30 days shipment; for soybeans: US, c.i.f. Rotterdam.

Stocks influence prices and they have a bidirectional relationship with commodity prices. During a period of low prices, firms tend to store more units of the commodity, and vice versa, when prices are high, holding of stocks is expensive and inventory tends to go to zero. To consider storage’s movements and their relationship with commodity prices, we include in the model the stock-to-use ratio variable computed as the fraction of the stocks to total consumption. Instead of using the actual stock-to-use ratio we use USDA monthly forecasts of stocks and consumption for the up and coming marketing year. Serra and Gil (2011) note that these forecasts are likely to be more effective in explaining price behaviour than the actual data, since they are more closely related to actual trading decisions, and thus are more relevant when explaining price behaviour.

Global demand may influence the price dynamics. One indicator is useful in detecting global demand. This indicator is the Baltic Dry Index (BDI). BDI is a measure of what it costs to ship raw materials around the world and measured as the average freight price to ship raw materials across the world. Therefore, it incorporates aspects of the economic activity and thus has the characteristics of represent global demand. The close association between the cost of shipping raw
materials and the production of intermediate and final goods, is behind the idea that the demand for commodities and, therefore, economic activity, is reflected by movements in the BDI. In synthesis, the BDI can be imagined as the equilibrium price of shipping raw material across various ocean routes. If the supply curve of shipping is inelastic especially in the short and intermediate run, changes in BDI are largely determined by changes in the global demand for dry bulk commodities (Kilian, 2009).

We use two different measures to quantify financialization. The first is the total open interest variable for the three commodities. Open interest is the total number of contracts that are open, and is a measure of the inflow of money into the futures market. Open interest of futures trading of the Chicago Board of Trade (CBOT) were obtained from the Commitment of Traders (COT) database of the U.S. Commodity Trading Commission (CFTC) for maize, wheat, and soybeans. The COT reports disaggregated open interest of futures trading positions as long, short, and spread by commercial and non-commercial participants. Since a spread represents the equal value of long and short positions, it is not included in our calculation of excessive speculative activities. As previously analysed, the excessive net long speculation may lead to price increases, while the excessive net short speculation can cause price decreases. One method to consider for possible effects connected to the financialization of the commodity markets is to analyse the commercial and non-commercial trading activities. In a perfect competitive market, the two positions should balance. However, due to the lack of effective data it is impossible to accurately define different kinds of trader positions.

The second measure has been recently proposed by Tadesse et al. (2014). They measure financialization as

$$ESV_i = (NCL_i - NCS_i) - (CL_i - CS_i)$$

where $NCL_i$ is the open interest of non-commercial long positions, $NCS_i$ is the open interest of non-commercial short positions, $CL_i$ is the open interest of commercial long positions, and $CS_i$ is the open interest of commercial short positions. The daily data have been collected from the COT. Daily data has been transformed in monthly frequency by averaging the trading days values in each specific month. Positive value for extended periods of time of $ESV_i$ could be associated with the existence of significant unsettled non-commercial positions motivated by the increasing use of food commodities as an asset class.
V. Empirical results and discussion

In this section, we apply causality tests in the frequency domain to assess the predictive content of financialization for maize, wheat and soybeans spot prices. We started our empirical analysis by investigating if the prices series are non-stationary. Various unit root tests have been used, augmented Dickey-Fuller, Dickey-Fuller GLS, Ng and Perron. Value of the autoregressive process $P$ has been computed by using the Akaike criterion. Since all the price series show non-stationarity in the autoregressive representation, we differenced all the variables. For the price series we use the log difference $\ln\left(\frac{P_t}{P_{t-1}}\right)$ (i.e. growth rates), for all the other variables, Open Interest ($OI_t$), $ESV_t$ in (6) and the stock-to-use ratio $stu_t$.

We first focus on the bivariate system, i.e. the models which include the price variable maize, wheat or soybeans, and the $OI_t$ or the $ESV_t$ financial variable. No cointegration is detected between the variables. The figures report the test statistics and the 5% critical values (broken lines) for all frequencies in the interval $(0, \pi)$. From Fig.1 reports in the first column the results for the bivariate system which include the open interest $OI_t$. It emerges that the test statistics do not reject the null hypothesis of no predictability. The result is in line with the literature that doesn’t find Granger causality from financial variables and food commodity prices, and it can be added, looking at Fig. 1, that the non-causality emerges at low as at high frequencies. Only for soybeans the result of the test statistics is close to the 5% critical value at the frequency $\pi$ that means around 2 months.

To investigate if the results depend on possible misspecification of the relationship which does not include other important variables that affect the commodity price determination, we estimate a multivariate VAR model. We include as variables the oil price and the stock-to-use ratio.

This is a measure of supply and demand interrelationships of commodities. The variable indicates the level of carryover stock for any given commodity as a percentage of the total demand or use. We finally include the BDI index as proxy of the demand. From Fig.1, second column, the results of the causality tests in the frequency domain indicate the non-predictability of the spot commodity prices by the open interest variable in the bivariate system (i.e. the non-causality of $OI_t$ on the commodity prices) cannot be attributed to the lack of a system of variables.

Next, we investigate in Fig. 2 whether there is predictive power of the $ESV_t$
variable over and above that provided by other variables which affect the maize, wheat and soybeans price series. The results of the bivariate system, included in the first column, highlight this time some predictability of the variable over the price series. This conclusion is for the maize and soybeans series. The result of the test does not show causality from $ESV_t$ to wheat price at all frequencies. Instead, it turns out that the null hypothesis of no predictability is rejected in the interval of the frequency $(1.27, 2.24)$ for the maize, corresponding to a cycle length between 3 and 5 months. For soybeans, the no predictability is rejected for frequencies in the interval $(0, 0.54)$. The predictability is then selected only in the long-run and for cycle length higher than 12 months. We check the previous results by estimating, as before for the $OIL$ variable, the value of the tests at all frequencies for a multivariate system which also include the oil price, BDI index, and the stock-to-use. Overall, the findings are quite like the ones obtained when assuming a bivariate system. The only difference is that now also the wheat price show predictability. This happen in the interval of frequencies $(2.24, 2.56)$ which corresponds to a cycle of length of 2-3 month. Soybeans and maize show test statistics like the previous of the bivariate system. In conclusion, the results imply first that food commodity prices for maize, wheat and soybeans can be predicted by the $ESV_t$, i.e. at some frequency the non-causality null hypothesis can be rejected at the 5% significance level. Secondly, the predictability is connected to a wave length of 3-5 months for wheat and maize. Thus, spot prices for maize and wheat are influenced by the financial variables in the short-run. Otherwise, the soybeans are only influenced in the long-run.
Figure 1: Causality tests. $OI_t$ variable. First column bivariate system, second column multivariate system
Figure 2: Causality tests. $ESV_i$ variable. First column bivariate system, second column multivariate system.
VI. Conclusions

In an environment where, through the financialization of commodity futures markets, commodity prices may not reflect changes in fundamentals, the price discovery mechanism can be seriously distorted. Prices can move far from levels justified by the fundamentals for extended periods, leading to an increasing risk of for consumers and producers. Due to these distortions, commodity prices do not always provide correct signals about the relative scarcity of commodities. One of worst results is the negative impact on the allocation of resources and on food markets. The conclusion, from an extended empirical analysis, is that financialization has amplified the price movements of food spot prices as wheat, maize and soybeans. Interestingly, spot prices for maize and wheat are influenced by the financial variables in the short-run, 3-5 months. Otherwise the soybeans are only influenced in the long-run.

We cannot compute the precise weight to be given to financialization. This measure is still disputed. However, we can conclude that the effect is not negligible calling for possible governments intervention.
References


CHAPTER 4

Market structures and Financialization: The Examples of Aluminum, Iron Ore and Steel Futures Markets

Yves Jégourel

Abstract

This article attempts to disentangle financialization from speculation in order to consider the extent to which a commodity industry shifts from producer-dominated prices to “pure” market prices, where the price of a futures contract serves not only for purposes of hedging but also as a reference price. With reference to aluminum, iron ore and steel, we subscribe to the rhetoric whereby the creation of a new futures contract, in keeping with the needs of upstream and downstream industrial players, cannot be taken for granted. The “supply creates its own demand” law could, in the financialization process, effectively operate and largely contribute to greater prevalence of these futures markets within commodity industries. We also suggest that financialization may gain momentum in the coming years and increasingly impact the upstream sector of metal industries.

Keywords: financialization, oligopoly, market power, industrial organization, EMH, futures markets, ores, metals.
I. Introduction

The phenomenon of commodity financialization has been widely studied, especially during the upward swing of the so-called “super-cycle”. Most of the related articles investigate to what extent steeply rising prices and, allegedly, the speculative bubble during the 2000 decade, might be explained by index investors and money managers i.e. by financial speculation. Indeed, if we refer to Adams and Glück (2015), financialization could be defined as a recent phenomenon which has seen huge inflows of money invested by institutional investors into commodity derivatives markets with, as a result, increased co-movements between not only commodity classes themselves (agricultural products, base metals, precious metals, energy products) but also commodity markets in general and traditional financial markets, namely stock markets\(^{21}\). By doing so, it seems though that most of these papers tend to assimilate financialization with speculation. In this chapter, we opt for a broader approach to financialization. We apprehend it as the path towards and in which financial markets, especially organized ones, tend to play a growing role within a given commodity industry. It has effectively been widely acknowledged that a number of benefits can be expected from the launch of a commodity futures contract.

First, it provides producers, end-users, processors and physical traders with a financial tool to deal with price short-term instability. It is a wherewithal to hedge price risk or to secure commercial margins in a much more efficient and flexible way than forward-price commercial contracts. It is indeed possible to eliminate price risk using a forward deal, i.e. by fixing in t0 the price(s) that will prevail one period ahead or during a period of time. However, in doing so, buyers and sellers trade a price risk against a counter-party risk which can be presumably higher considering the traditional significant level of volatility seen with commodity prices. Any durable deviation of the market price from the agreed price would indeed increase the incentive for one or the other counter-party not to fulfill its contractual obligations in order to benefit from this favorable shift. As both buyers and sellers are fully aware of this risk, which cannot be mitigated, they tend to favor contracts where quantities that are about to be traded are specified but not priced. The price risk that stems from this kind of contract could hence be hedged using derivatives contracts, which will be bought (sold) and sold (repurchased).

\(^{21}\) Adams and Glück (2015) assert that these co-movements are not only due to distressed investors selling their risky assets (i.e. stocks and commodities) during the 2007-2009 financial crisis, but also to the fact that commodities were increasingly seen as a new class of asset affording better portfolio diversification and better risk-adjusted returns.
in \( t_0 \) and \( t+n \). In this respect, futures contracts have to be considered not only as temporary substitutes for commercial transactions (Gray and Routlege, 1971) but also as imperfect substitutes. It is well known that using futures for hedging purposes is an arbitrage between a flat price risk and basis risk that is assumed to be low. In this respect, the effective price paid (perceived) will be equal to the price at which the producer (end-user) has sold (bought) its futures contracts plus or minus the variation of the basis\(^{22}\). The second benefit that can supposedly be expected from the creation of a commodity futures contract is that it promotes the transmission of available information and therefore prompts price transparency. There are several ways to understand this statement. Firstly, as written by Black (1976, p. 174):

“futures prices provide a wealth of valuable information for those who produce, store and use commodities. Looking at futures prices for various transaction months, participants in this market can decide on the best times to plant, harvest, buy for storage, sell from storage, or process the commodity”.

Secondly, commercial transactions are by nature private operations, meaning that the price that has been mutually agreed upon is not observable. A futures price is, on the contrary, publicly displayed. By offering a reference price, accessible to all industry players and usable as a negotiating basis\(^{23}\), an organized market thus provides the wherewithal to reveal, to a certain extent, the sales margins of each player and to steer their commercial and financial strategies. Spatial dispersion of prices could therefore be reduced (Rashid et al., 2010). Considering these two benefits leads to a straightforward conclusion: financialization will occur if there is, within a given industry, a push for more price transparency and a need for hedging tools. Another way to consider how a commodity industry could become “financialized” is to adopt the commodity exchange perspective and consider the launch of a new contract as a business opportunity that will be exploited if the following pre-conditions are met: (1) high price volatility, (2) product homogeneity where quality differences could be priced using a system of premiums and discounts, (3) a large and liquid cash market, (4) a sound banking environment and (5) the appropriate legal regulatory frameworks. This, however, does not guarantee a successful outcome. If the contract specifications (size,
quality, delivery conditions, ticks, eligible delivery months) are ill-designed, the contract will not catch the attention of short and long hedgers and/or speculators and therefore will not be actively traded. The contract should in particular be designed so as to reduce the basis risk and to induce a balanced market thanks to speculation. For Gray (1966, p. 121):

“The sales and purchases that hedging firms have to make cannot be expected to sustain a balanced futures market, even when the contract is fair and there is reasonable competition on both sides. One reason for this is that a futures market needs liquidity, which hedging firms do not provide, but a more important reason is that hedging is nearly always unbalanced in favor of the short side”.

However, it is worth noting that the launch of a given contract, that does not meet with immediate success, does not necessarily mean that there is no potential for financialization. It should be considered more as a first attempt. The reality of the financialization process is of course far more complex than what some would have us believe and cannot be apprehended without reference to the future contract’s underlying asset. The ambition of this chapter is therefore to consider three specific commodities: iron ore, aluminum and steel. This was not a random choice, as each one illustrates both the prerequisites and constraints that pave the way towards industry financialization.

The rest of this chapter is organized as follows: section 1 will review the characteristics of these three different futures contracts and touch upon their conditions of emergence. Section 2 will address a specific issue: to what extent might an oligopoly market structure hamper the development of a futures market? We conclude by considering what could be the next steps towards financialization in mineral industries.

I. The path towards financialization for the aluminum, iron ore and steel markets

As summarized by Radetzki (2013), there are multiple pricing agreements which could be made to trade a given commodity: (1) transfer prices for vertically integrated groups, (2) posted prices imposed by commodity producing countries
so as to maintain the level of their export fiscal revenues, (3) auctions, (4) producer prices, i.e. commercial prices reflecting both production costs and profit margins, and (5) pure market prices resulting from bilateral negotiations or derived from a reference price\textsuperscript{24}. The latter could in turn be based on futures prices or based on benchmarks regularly published by agencies such as Platts, ICIS, CRU or Metal Bulletin\textsuperscript{25}. In this context, we define financialization as any shift that would use futures prices as reference prices. The financialization process does not end with futures contracts, though, and commodity options, or more precisely, options on commodity futures, are also sometimes available to hedge price risk with greater flexibility. Some commodity swaps may also be cleared on commodity exchanges. For the sake of simplicity, and with no change to the terms of the debate over financialization, this aspect will not be described in the following section. However, what matters more, as suggested by Figuerola-Ferretti and Gilbert (2001), is that the kind of contractual agreement that prevails in a given industry is allegedly not without influence on the related commodity price dynamics and, in particular, its volatility. It is indeed a generally held belief that greater transparency of exchange-based prices comes at the price of increased volatility. Empirical studies tend to counter this view.

1. Aluminum

Primary aluminum future contracts started to be traded in December 1978 on the London Metal Exchange, the world's largest non-ferrous metals market. At that time, only copper, tin, lead, zinc and silver were quoted on an exchange established in 1877. The importance of the LME is such that the vast majority of commercial contracts for non-ferrous metals are now priced using LME official prices published every open day. This is valid for any processing step for metals (ores, concentrates, cathodes or ingots, or any other shape) either for spot contracts with firm prices, or as benchmark reference-price contracts\textsuperscript{26}.

\textsuperscript{24}Radetzki (2013) distinguishes “bilateral contracts” from “commodity exchanges contracts” but recognizes that “bilateral contracts often employ the price levels set elsewhere, e.g. on commodity exchanges, as guiding posts for their price determination” (p. 267). In this article, we willfully acknowledge that both pricing mechanisms are based on market forces.

\textsuperscript{25}As written by Figuerola-Ferretti and Gilbert (2005, p. 969), “reference prices were published in trade journals, based on averages or estimates of the price at which recent transactions were made. These related to specific circumstances (location, grade etc.), which may not have been representative of the market as a whole. Sample sizes may have been small and reported transaction prices may therefore have been noisy”.

\textsuperscript{26}Thus, in a one-year contract with monthly deliveries, the monthly commercial price will be the result of a more or less complex formula (depending on the type of product that is traded, i.e. concentrates vs pure metals) which will often include LME official daily prices averaged over the quotational period.
Albeit fully used to hedge price risk, it is important to notice that LME contracts do not function in the same way as other traditional futures contracts. The LME defines itself as a forward terminal market, meaning that it can fulfill two fundamental functions: providing hedging instruments (and therefore speculative tools for money managers), and allowing good management of metal availability thanks to the substantial number (600) of LME-approved warehouses worldwide. Moreover, and as opposed to genuine futures contracts, profits or losses that stem from the trading of LME futures are paid solely at maturity. It is also worth noting that the LME works as a “maturity” market rather than a prompt date market. Futures contracts, which are physically settled, are indeed traded on fixed time spreads and moving prompt dates which can be chosen on a daily basis out to three months, on a weekly basis out to six months and on a monthly one out to almost ten years (123 months). By way of anecdote, three-month maturity corresponded to the time needed to ship tin from Malaysia or copper from Chile to the United Kingdom at the time the LME was created, whereas the daily prompts were designed to consider the high degree of uncertainty surrounding the date of delivery of metals to European ports (Mouak, 2010b).

Unsurprisingly, this move towards financialization was not much appreciated by industrial players, who alleged that it would open up the price of aluminum to the vicissitude of speculation and add volatility to prices. Many players even declared that they would consequently not use the LME price as a reference price and maintain their policy of established long-term prices reflecting cost trends and underlying market conditions. While traded volume and open interest were low in the early months of quotation, aluminum future contracts have still met with success. Aluminum now accounts for 39% of LME annual trading volume and it would be difficult now to imagine a primary aluminum market working without a futures market to hedge price risk. Two new contracts have been launched since the onset of the primary aluminum futures contract: with aluminum alloys in 1992 and with the North American Special Aluminum Alloy Contract (NASAAC) in 2002. More recently, futures on LME premiums have been introduced. Although LME prices should be considered as global benchmark, they do not fully reflect the specific pressures that exist on some regional or local markets. As a result, the effective physical price of metals is equal to the LME (cash buyer, cash seller) price.

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27 i.e. 3, 6, 12, 15, 27, 63 and 123 months.
28 Other commodity exchanges such as the Chicago Mercantile Exchange (CME) or the InterContinental Exchange (ICE) use monthly prompt dates and not periods of time like the LME to quote their futures contracts.
29 After the opening of the Suez Canal in 1869.
30 At the beginning of the LME in 1877, copper and tin were the only two metals to be traded. Lead and zinc were introduced in 1920.
plus a premium or a discount. This differential responds to the development of local market fundamentals and obviously evolves over time. It is consequently part of the overall price risk and legitimizes the availability of hedging instruments, i.e. futures on premiums. These instruments are also available on the Chicago Mercantile Exchange (CME) for the US, European and Japanese markets.

**Figure 1: Long term price dynamics of aluminum (CFR<sup>31</sup> China)**

Source: The World Bank, the Pink sheet

The LME and the CME are not the only marketplaces to trade aluminum futures. Such contracts can also be found on the Multi Commodity Exchange of India (MCX), and the Shanghai Futures Exchange (SHFE). Denominated in Chinese yuan (RMB), the SHFE futures contract is, however, for now intended for domestic purposes with a lot size of 5MT, deliverable in any of the fifteen SHFE certified warehouses, all located in China. Consequently, and despite its growing liquidity, the Chinese aluminum futures contract does not appear to serve as an international benchmark. This is even more the case for the Indian MCX futures contract.

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<sup>31</sup> Cost and Freight.
Table 1: Main aluminum futures contracts

<table>
<thead>
<tr>
<th>Exchange</th>
<th>settlement</th>
<th>underlying asset</th>
<th>Reference price/delivery venues</th>
<th>Contract Size</th>
<th>Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>LME</td>
<td>physical</td>
<td>Primary aluminum</td>
<td>LME warehouses (worldwide)</td>
<td>25 T and 5 T (mini)</td>
<td>USD (quotation) + GBP, JPY, EUR (clearable)</td>
</tr>
<tr>
<td>LME</td>
<td>physical</td>
<td>Aluminum alloys</td>
<td>LME warehouses (worldwide)</td>
<td>20 T</td>
<td>USD (quotation) + GBP, JPY, EUR (clearable)</td>
</tr>
<tr>
<td>LME</td>
<td>physical</td>
<td>NASAAC</td>
<td>LME warehouses (worldwide)</td>
<td>20 T</td>
<td>USD (quotation) + GBP, JPY, EUR (clearable)</td>
</tr>
<tr>
<td>LME</td>
<td>cash</td>
<td>Aluminum premium</td>
<td>Midwest and South US, Western Europe, Eastern Asia, South-Eastern Asia</td>
<td>25 T</td>
<td>USD</td>
</tr>
<tr>
<td>SHFE</td>
<td>physical</td>
<td>Primary aluminum (ingots, 99.7%)</td>
<td>SHFE Warehouses</td>
<td>5 T</td>
<td>RMB</td>
</tr>
<tr>
<td>CME (COMEX)</td>
<td>physical</td>
<td>Primary aluminum</td>
<td>US (Midwest, Platts), Europe (Duty paid and un paid, Metal Bulletin), Japan (Platts)</td>
<td>25 MT</td>
<td>USD</td>
</tr>
<tr>
<td>CME (COMEX)</td>
<td></td>
<td>Aluminum premium</td>
<td></td>
<td>25 MT</td>
<td>USD</td>
</tr>
<tr>
<td>MCX</td>
<td></td>
<td>Primary aluminum</td>
<td>Exchange designated warehouse at Bhiwandi</td>
<td>5 T</td>
<td>INR</td>
</tr>
</tbody>
</table>

Source: Commodity Exchange websites

To the list in table 1 should be added the futures contract for alumina, launched by the CME in October 2016. Allowing for physical delivery with a lot size of 25 MT, this contract is, along with iron ore futures, the only derivative at the upstream phase of metal industries and could prefigure what will be the next move in commodity exchanges regarding the financialization of commodity supply chains.
2. Steel

The emergence of steel futures contracts was quite recent compared to other industrial metals despite the considerable size of this commodity’s commercial markets. As with aluminum, many major steel-makers considered that any financialization of their market would foster destabilizing speculation. As written by Arik and Mutlu (2014, p. 1):

“(…) the steel community met the introduction of steel futures with skepticism, at the core of which was the potential impact on price volatility. Financial investors who would follow the introduction of the steel futures, were the potential “usual suspects”.”

A second major explanation for this delay is most probably that there is no “one size fits all” contract for steel. As opposed to primary aluminum, there is not a single market for steel, rather a multitude of submarkets driven by their own fundamentals. In this respect, steel prices, albeit interconnected due to the overwhelming role of China, may nonetheless bifurcate from time to time. It is indeed important to distinguish between long steel (with rebars and wires, amongst others) and steel plates and, within steel plates, hot rolled coils (HRC) and bands (HRB) from hot rolled plates. Additionally, there is no global market for steel, rather regional markets including the US, Europe and China. This multiplicity of products and markets is not uncommon and may also be observed on energy markets, from crude oil to LNG. It would not be an obstacle for financialization if they were largely interconnected, thus allowing steel reference prices to exhibit a high and stable degree of correlation. This statistical property does not appear to be verified, however, meaning that a single global futures contract on steel could not meet, per se, the wide variety of hedging needs even if its specifications were perfectly defined.

The financialization of steel markets is, by contrast, conditional upon the multiplicity of steel futures contracts comprising various kinds of underlying assets and delivery locations. Over the past two decades, many exchanges have attempted to trade steel futures based on a variety of products. Such contracts have had varying degrees of success. Thus, the LME launched in April 2008 two physically-delivered futures contract for steel billets with two delivery points: Turkey and South-Korea, the world’s two main importers. The LME then attempted to merge these two contracts in order to create a single steel futures contract with various delivery locations, including the US (Chicago, Detroit, and New Orleans). This
contract has now disappeared to give way to two “less ambitious” cash-settled contracts on steel scrap and rebar. Furthermore, trading has ceased for other futures contracts on the Dubai & Gold Commodity Exchange (rebar), the Indian National Commodity and Derivatives Exchange and on the MCX (flat and long steels).

### Table 2: Major steel futures contracts

<table>
<thead>
<tr>
<th>Exchange</th>
<th>settlement</th>
<th>underlying asset</th>
<th>Reference price/ delivery venues</th>
<th>Contract Size</th>
<th>Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>LME</td>
<td>cash</td>
<td>Steel scrap</td>
<td>HMS #1&amp;2 80:20, CFR Iskenderun Port Index</td>
<td>10 MT</td>
<td>USD</td>
</tr>
<tr>
<td>LME</td>
<td>cash</td>
<td>Rebar</td>
<td>Platts Rebar, FOB Turkey Port Index</td>
<td>10 MT</td>
<td>USD</td>
</tr>
<tr>
<td>CME</td>
<td>cash</td>
<td>Hot-rolled Coil (CRC)</td>
<td>CRU U.S. Midwest Domestic Hot-Rolled Coil Steel Index.</td>
<td>20 ST</td>
<td>USD</td>
</tr>
<tr>
<td>CME</td>
<td>cash</td>
<td>Ferrous scrap</td>
<td>AMM U.S. Midwest Busheling Ferrous Scrap</td>
<td>30 GT</td>
<td>USD</td>
</tr>
<tr>
<td>CME</td>
<td>cash</td>
<td>Ferrous scrap</td>
<td>Platts HMS 80:20 Ferrous Scrap –CFR Turkish Port</td>
<td>50 MT</td>
<td>USD</td>
</tr>
<tr>
<td>SHFE</td>
<td>physical</td>
<td>Rebar</td>
<td>SHFE Certified warehouses</td>
<td>10 T</td>
<td>RMB</td>
</tr>
<tr>
<td>SHFE</td>
<td>physical</td>
<td>Wire rod</td>
<td>SHFE Certified warehouses</td>
<td>10 T</td>
<td>RMB</td>
</tr>
<tr>
<td>SHFE</td>
<td>physical</td>
<td>Hot-rolled Coil (HRC)</td>
<td>SHFE Certified warehouses</td>
<td>10 T</td>
<td>RMB</td>
</tr>
<tr>
<td>SGX</td>
<td>cash</td>
<td>HRC</td>
<td>TSI Steel CFR ASEAN Index</td>
<td>20 T</td>
<td>USD</td>
</tr>
</tbody>
</table>

Source: Commodity Exchange websites

As shown by table 2, several steel futures contracts are now traded but with significant heterogeneity in terms of liquidity. As of October 17, open-interests of CME steel futures were respectively hovering around 16,376 for CRC, 680 for US Midwest HRC and... 0 for CFR Turkey Ferrous scrap. Moreover, most of them are cash-settled against various indexes and in this respect it would be difficult to claim a high degree of financialization for steel markets. The only futures that are physically settled are indeed rebar and wire rod, but both are denominated in yuan (RMB). Such characteristics explain why these contracts cannot be used for hedging purposes by non-Chinese industrial customers. Because of its high liquidity and since China is by far the world’s most important steel producer, SHFE rebar futures are nevertheless being closely monitored and observed by the...
rest of the planet. It is worth noting that, according to the 2016 IOMA Derivatives Market Survey\textsuperscript{32}, this contract was the most heavily traded commodity futures contract in 2016, with the SHFE being the world’s largest exchange in number of commodity options and futures contracts traded that year\textsuperscript{33}.

### 3. Iron ore

Although a contract on iron ore was traded on the LME from 1877 to 1920, the financialization of the iron ore market is quite a recent event. The Dalian Commodity Exchange (DCE) effectively launched this kind of contract in October 2013. Along with the CME alumina contracts, it figures among the very few physically delivered contracts whose underlying asset is an ore or a concentrate and not a metal. The DCE iron ore contract proved to be the fourth most heavily traded commodity futures contract in 2016 with a volume of 342.26 million contracts.

**Figure 2: Long term price dynamics of iron ore (CFR China)**

![Figure 2: Long term price dynamics of iron ore (CFR China)](image)

Source: The World Bank, the Pink sheet

\textsuperscript{32} Available on the World Federation of Exchanges website: http://world-exchanges.org

\textsuperscript{33} 934.15 million steel rebar futures contracts were traded on the SHFE in 2016. This statistic should not be over-interpreted, though, since it does not paint the whole picture of commodity exchange competition, where geographic outreach is still a key variable. In this area, the DCE and the SHFE seem, for now, to be largely outweighed by the CME and ICE (US and Europe).
As shown in table 3, iron ore futures can also be traded on the CME, the ICE Europe or the Singapore Commodity Exchange (SGX) but as opposed to DCE contracts, these are financially-settled against different kind of indexes (Platts, TSI, Metal Bulletin).

**Table 3: Main iron ore futures contracts**

<table>
<thead>
<tr>
<th>Exchange</th>
<th>settlement</th>
<th>underlying asset</th>
<th>Reference price/delivery venues</th>
<th>Contract Size</th>
<th>Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCE</td>
<td>physical</td>
<td>Iron ore</td>
<td>DCE warehouses and delivery locations appointed by DCE</td>
<td>100 MT</td>
<td>RMB</td>
</tr>
<tr>
<td>ICE (Europe)</td>
<td>cash</td>
<td>Iron ore price index</td>
<td>Platts IODEX 62% Fe daily index, CFR North China</td>
<td>1,000 DMT</td>
<td>USD</td>
</tr>
<tr>
<td>ICE (Europe)</td>
<td>cash</td>
<td>Iron ore price index</td>
<td>The Steel Index (TSI) Iron Ore 62% Fe, CFR Tianjin</td>
<td>500 or 1,000 DMT</td>
<td>USD</td>
</tr>
<tr>
<td>ICE (Europe)</td>
<td>cash</td>
<td>Iron ore price index</td>
<td>Difference between the Platts daily assessment price for IODEX 62% Fe and TSI daily assessment price for Iron Ore</td>
<td>1,000 DMT</td>
<td>USD</td>
</tr>
<tr>
<td>CME (Nymex)</td>
<td>cash</td>
<td>Iron ore price index</td>
<td>TSI Iron ore fines 62% Fe - CFR China Port</td>
<td>500 DMT</td>
<td>USD</td>
</tr>
<tr>
<td>CME (Nymex)</td>
<td>cash</td>
<td>Iron ore price index</td>
<td>Iron ore fines 58% Fe, low alumina – CFR China</td>
<td>500 DMT</td>
<td>USD</td>
</tr>
<tr>
<td>SGX</td>
<td>cash</td>
<td>Iron ore price index</td>
<td>TSI iron ore (58% Fe or 62% indexes)</td>
<td>100 T</td>
<td>USD</td>
</tr>
<tr>
<td>SGX</td>
<td>cash</td>
<td>Iron ore price index</td>
<td>Metal Bulletin iron ore (58% Fe) index</td>
<td>100 T</td>
<td>USD</td>
</tr>
<tr>
<td>SGX</td>
<td>cash</td>
<td>Iron ore lump premium</td>
<td>Platts IO Spot Lump Premium 62.5% CFR China Index</td>
<td>100 T</td>
<td>USD</td>
</tr>
</tbody>
</table>

Source: Commodity Exchange websites

Although most futures contracts relate to iron ore with a 62% iron content and on a China CFR incoterm basis, the growing price divergence between iron ore with different grades has led commodity exchanges such as the CME and the SGX to launch cash-settled contracts on iron ore with 58% Fe iron or on premiums paid for 62.5% Fe iron ore. While the price of 65% Fe iron ore has recently appeared to
be largely disconnected from the 62% counterpart, there is however, to the best of our knowledge no futures contract based on this grade at the present time.

Several lessons can be drawn from this introduction to aluminum, steel and iron ore futures contracts. First and foremost, each of these markets are going through different degrees of financialization even when only exchange-traded instruments are considered, with aluminum being by far the most financialized of the three. Secondly, and aside from China and, to a lesser extent the US, the geography of commodity exchanges is no longer aligned on the localization of main producing areas for the three metals under consideration. As far as iron ore is concerned, there are effectively no derivatives with underlying assets on Australian or Brazilian commodity exchanges, for example. This testifies to the fact that commodity derivatives markets are highly competitive and that there is room for no more one or two similar futures contracts when their underlying asset is traded globally. In this respect, the multitude of cash-settled index futures on iron ore – a sign, amongst others, of the significance of this market and of the intense competition now raging between exchanges to conquer it - may probably not last long. A brief look at the history of commodity exchanges also reveals that the perennial success of a new contract does not depend solely on the soundness and extensiveness of market analysis or on the corresponding contract design, but also, as probably any new industrial/commercial product or even service, on intuition and, admittedly, a bit of luck. In this respect, it is important to recall that the dismissal of a given exchange-traded derivative should not necessarily be interpreted as a sign that the related commodity industry is “immunized” against financialization. Rather, it should be seen as an attempt to show that, amongst other explanations, the contract specifications should be improved or the marketing campaign towards potential users be stepped up.

II. Financialization: cause, consequence or catalyst of changing market structure?

The financialization of commodity markets has proven to be a key subject that has been examined in many different ways. The Efficient Market Hypothesis (EMH), one of the cornerstones of financial theory, has unsurprisingly

34 In a different, but not-unrelated, sphere, it highlights that Continental Europe Commodity Exchanges such as Euronext (France) or Eurex (Germany) have been pushed into the background as far as industrial metals are concerned.
been tested for commodity commercial and futures markets, taken as a whole using commodity indexes or considered for a specific class of commodities. Nevertheless, with the 2004-2012 “supercycle” and resulting political concerns, the influence of speculators on commodity price dynamics has probably been the preferred angle of approach over the past decade (Irwin and Sanders, 2012; De Meo, 2013; Büyükşahin and Robe, 2014; Etienne et al., 2014). In line with these long-standing attempts to measure certain consequences of financialization, many empirical academic articles have set out to establish whether the alleged benefits or shortfalls of commodity-based financial markets are grounded. Articles that focus solely on industrial metals appear to be sidelined when compared with papers dedicated to energy products or precious metals. As far as we know, even fewer have endeavored to enter the much more complex “causes-consequences” debate to ascertain whether or not the onset of a commodity futures contract/market could ever trigger a profound change in the observed commodity industrial apparatus. It is indeed a classic and widely accepted belief that the launch of these kinds of derivatives will be successful if it meets pre-existing needs such as price transparency and viable risk transfer mechanisms. While this assertion may doubtless be justified with sound arguments, it might be unwise to dismiss the opposite view whereby the derivatives/exchanges industry is no different to other competitive industries inasmuch as it has to innovate in order to maintain or gain market shares. In this context, the idea that the launch of new tool, usable both as a reference price and, in a self-referential way, to hedge price risk and create its own demand, should not be ignored. Although empirical testing of such intuition may probably be hard to achieve, the marketing plans that accompany the rollout of any new commodity derivative may be considered as a first piece of evidence to corroborate this view.

1. Financialization, informational efficiency and commodity investing

Among articles that focus solely on base metals, a large number have been devoted to testing the EMH under which futures prices constitute an unbiased estimator of spot prices that prevail at the contract prompt date if risk neutrality holds. Figuerola-Ferretti and Gilbert (2001) have analyzed the dynamics of

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35 At the end of 2007 and the first semester of 2008, soaring agricultural prices fueled social unrest and food riots which led the international community, especially during the G20 summits, to condemn speculation and urge the adoption of measures to curb it.

36 For a totally comprehensive review of literature on speculation on commodity markets, see Haase et al. (2016).
aluminum prices over the period. Using both linear and two-regime error correction models (ECM)\textsuperscript{37} with GARCH-in-Mean effects that allow for time-varying risk premiums, Arouri et al. (2011) have also endeavored to characterize the short- and long-term speculative efficiency of aluminum LME weekly spot and three-month forward prices over the period between January 1979 and December 2009. In this study, while prices appear to be co-integrated, hypotheses of short-term and long-term efficiency together with risk-neutrality hypotheses cannot be accepted. This appears to be even truer when deviations between spot and future prices are high. Under such circumstances, futures prices can indeed be used to forecast future spot prices.

A similar econometric analysis was carried out by Arik and Mutlu (2014) on steel rebar futures traded on the SHFE between March 27, 2009 and March 14, 2014, measuring steel price volatility before and after the launch of the contract. Based on daily observations, the authors confirm, in line with existing articles on the subject, the existence of a bilateral relationship between spot and futures prices, both in the long- and the short-term. In the long run, the spot market appears to be the key driver of steel prices, whereas impact from the futures market proves to be stronger in the short run. The authors also show that Chinese steel prices and three main commodity indices (London Metal Exchange Metal Index, S&P Commodity Index and S&P Industrial) shifted towards co-integration after the advent of steel futures trading on the SHFE. Interestingly, they also indicate not only that GARCH models, a mainstream tool to characterize financial prices, become suitable to model the volatility of spot steel prices only in the post-futures period, but also that volatility declines over this period.

This latter aspect was also examined much earlier by Figuerola-Ferretti and Gilbert (2001) for LME aluminum futures prices. Further to seminal works initiated by Gray (1963), Peck (1976) or Powers (1970), the authors indeed question the impact of futures trading on the volatility of aluminum commercial prices proxied by LME spot prices and Metal Bulletin (MB) reference prices. To this end, they divided the period under study (January 1970-June 2000) into three sub-periods: (i) January 1970-December 1978, prior to the launch of the LME aluminum futures contract, (ii) January 1979-December 1985, considered as an intermediate period marked by the coexistence of a producer-based pricing system and LME-

\textsuperscript{37} This two-regime ECM allows the adjustment between spot and forward prices to be regime-dependent. When the spread between these two prices is low, arbitrage transactions that allow prices to converge cannot be carried out. On the contrary, when there are large deviations between spot prices and futures prices, the latter may be used to predict the spot prices that will prevail in the future, meaning that the EMH should be rejected.
based reference prices, and (iii) January 1986-June 2000, the post producer pricing period. Although the volatility of MB prices appears to be much higher during the third sub-period, Figuerola-Ferretti and Gilbert (2001) suggest that this is only due to anomalous high volatility in the eighties which disappeared in the nineties. For this latter decade, volatility appears neither higher or lower than that seen in the seventies.

In the same vein, Mayer et al. (2017) examined the price dynamics (trends and volatilities) of four precious metals (gold, platinum, palladium and silver) and one base metal (copper), all traded on the New-York Mercantile Exchange (Nymex) over the period between January 1993 and December 2013. However, as opposed to the above-mentioned studies, their analysis is not focused on the EMH, rather on the influence of index and money managers, i.e. speculators, on commodity price levels and volatilities. To do so, they used commitment of trader (COT) reports issued by the US Commodity Futures Trading Commission (CFTC) to distinguish between hedgers (non-commercial traders) and speculators. They then ran Granger-causality tests to apprehend the interactions between trading positions and spot prices. The authors found some asymmetries between these two sets of variables: while trading activity, despite some distinct econometric results, does not seem to have a great influence on spot logarithmic returns in the long run, the reverse cannot be ruled out, with differences being observed between precious metals and copper. For the latter, the impact of price development turns out to be greater. It also appears, contrary to common belief, that commercial traders have a more significant impact on spot prices than their non-commercial counterparts, especially when considering their long positions.

Cummins et al. (2015) also considered the impact of financialization of metals prices and, indirectly, the efficiency of metal markets in an original and very intuitive manner. Following the seminal work of Aggarwal and Lucey (2007) on gold, they effectively tested the existence and the significance of certain psychological price levels (price clustering and psychological barriers) for the seven non-ferrous metals traded on the LME: aluminum, aluminum alloys, copper, lead, nickel, tin and zinc. It is no secret that numerous traders use a so-called technical analysis, which combines support and resistance levels to define chart patterns (triangles, flags, pennants, etc.), to form their expectations over

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38 open interest, number of traders, total reportable positions-long, total reportable positions-short, commercial positions-long, commercial positions-short, non-commercial positions-long, non-commercial positions-short.

39 Technical analysis is also based on statistical indicators such as exponential moving average, moving average convergence divergence, oscillators, Bollinger bands, etc.
future prices alongside fundamental analysis. Using a database of daily cash prices from December 3, 1993 to December 5, 2013, Cummins et al. (2015) adopted barrier proximity tests to gauge whether considered metal prices hovered around psychological barriers more often than a uniform distribution would allow for, but also barrier kurtosis tests that can reveal the existence of specific frequency distribution specific shapes around barriers. These barriers are reasonably set every 100 USD/T & 1000 USD/T with +/-2%, +/-5% and +/-10% band ranges. Some of the results obtained include the irrelevance of USD 100 barriers (aside from lead) and, unsurprisingly, the confirmation of the presence of USD 1,000 barriers with negative clustering for copper, aluminum, lead, and aluminum alloy. Using dummy variables to explain price returns before and after (up to ten days) a downward/upward breach of these barriers, Cummins et al. (2015) confirmed that metal prices usually behave differently in such contexts, particularly after an upward breach.

2. Financialization and patterns of commodity industries

To the best of our knowledge and with the notable exception of Brault (2008) and Nappi (1985, 1989), there are very few articles dealing with the conundrum that links, for a given commodity, the financialization process to the industrial organization that produces, processes, trades and consumes this commodity. Due to the age of its financialization but also to its very volatile nature over the last five decades, the aluminum industry is probably the best case study to question the existence this fundamental issue. From the 1950s to the late 1970s, the primary aluminum market had indeed been characterized by an oligopoly of six firms known as the “six majors”, Alcan (Canada), Alcoa (United States), Alusuisse (Switzerland), Kayser (United States), Pechiney (France) and Reynolds (United-States). In the early seventies, these firms held an aggregate market share of 60% for bauxite, approaching 80% for alumina and hovering around 73% for primary aluminum. This oligopoly was a key condition for the aluminum market to move back to balance through quantities rather than using prices. To quote Nappi (2013, p. 8):

“Forty years ago, the peaks and troughs of aluminum demand were managed by changes in capacity rates of utilization or inventory accumulation but as little as possible by changes in price. This was the period dominated by producers’ list prices which were typically rigid despite considerable instability in market conditions.”
Although these administered and rigid list prices were transparent, it has nonetheless emerged that discount practices were not uncommon (Nappi, 2005; Radetzki, 1990; Brault 2008) to partly reflect surrounding economic instability. At all events and as shown in graph 1, observable prices remained stable and there was clearly no market opportunity for commodity exchanges to launch a future contract, or any derivative, on primary aluminum, and that this situation would last for as long as there was both a possibility and an incentive for historical producers to drive prices. For the latter, this implied being able to adjust quantities of metal available on the market through storage and/or through rapid variations in their capacity utilization rates, and doing so in a coordinated manner so as to avoid free-rider behavior that would inevitably jeopardize such a strategy (Yang, 2002; Nappi, 2013). As pointed out by Nappi (1985), the ability for producers to ensure stable prices depends on three main variables: (1) the shape of their cost functions; (2) the price-elasticity of demand and (3) their ability to coordinate their production and pricing decisions. Although the aluminum producing process appeared to be rather rigid, the low price-elasticity of demand which prevailed prior to 1970 allowed the six majors to act as undisputed global price-makers.

Several elements appeared during the seventies to put a halt to these generally favorable conditions. Firstly, both the presence of superprofits tied to this oligopolistic situation and the evolution of comparative advantages in the wake of the first oil crisis in 1973 drove outsiders, private producers and also state-owned enterprises (SOE) to enter not only the aluminum business but also the bauxite and alumina segments. The rationale was not solely financial; it was also political in order, for demanding countries, to secure their supply in raw materials. According to Mouak (2010a, p. 14), the share of the government sector in the aluminum industry thus grew from 10% in the late sixties to 25% in the early eighties. Secondly, slower growth in demand led inevitably to a growth in excess supply and intensified competition among producers with profits diminishing accordingly. Thirdly, the increase both in the nature and the number of producers led to a decrease in the aluminum industry concentration ratio (Nappi, 1985 & 1989) and serious complicated industry coordination. The growing presence of SOE, in particular, has created the conditions for major divergences among producers, particularly when prices were declining. Finally, the price-elasticity of

40 Sizable economic literature is devoted to analyzing the link between price stickiness and market concentration. Since this aspect does not lie at the core of our analysis, we will not go into detail.
42 Due to high fixed-to-total costs ratio, the presence of “take-or-pay contracts” for energy, the low to moderate possibility of switching input sources, and high stability of technology (Nappi, 1985).
demand increased due to the development of alternative products for aluminum and the economic, technological and environmental impetus that was given to secondary aluminum. As aluminum real prices were following a downward trend (see graph 3), the ability to adjust variable production costs was also a key feature to explain the loss of market power for the six majors.

**Figure 3: Long term real prices of aluminum (1990-2015, 1998 USD/T)**

![Graph showing long term real prices of aluminum](image)

Source: USGS

Due to the above-mentioned factors, the costs of remaining in a producer-price conundrum began to exceed potential benefits, which led to the development of a “free market” and the advent of related reference prices, such as MB or, later, LME, which have increasingly asserted themselves as the real market reference.

Among the very few empirical studies to corroborate this view, the work led by Figuerola-Ferretti and Gilbert (2005) appears to be of great value. The authors effectively investigate the informativeness of LME prices using the Beveridge-Nelson decomposition method\(^{43}\). The purpose of this method is to distinguish between a trend component and a transitory component (itself defined as a combination of a cycle and a noise) within non-stationary data series. If a given market meets EMH conditions, then the transient component should be equal to

zero. Alternatively, if the transitory/permanent variances ratio is high, then it is possible to conclude that the considered series exhibits a low level of information content regarding the underlying trend. Taking into account four sources of aluminum prices (monthly North American aluminum producer list prices from 1970 to the end of 1985, MB reference prices from January 1970 to February 1989, daily LME cash prices from October 1979 to December 2003 and Comex settlement prices from December 1983 to February 1989 and from June 1999 to December 2003), and dividing the overall period (January 1970-December 2003) into five sub-periods, Figuerola-Ferretti and Gilbert (2005) suggest that even within the very first years, the LME contract, which revealed lower transient variance, was consistently more informative about the fundamental price of aluminum than producer prices or MB references prices. It therefore made economic sense that the LME contract should become established as a global benchmark for aluminum. This view is confirmed by Brault (2008).

What remains unclear, though, is the role played by the launch of the LME aluminum contract to hasten the demise of administrated prices and undermine the existing oligopoly. While numerous prerequisites for this profound mutation were met prior to 1978, the success for such a move certainly could not be taken for granted. As summarized by Tarring (2007):

“(…) it was an act of fact on the part of the LME to launch the contract. But the LME correctly predicted that the continuing weight of metal seeping out of the then Eastern Bloc, together with the small amount of independent (and therefore not vertically integrated) Western production would generate sufficient volume for the new contract to take root. In the early stages it was touch and go but changes to the contract specifications a couple of years after launch to make the Soviet metal more deliverable was a turning point from which the contract never looked back”.

The collapse of the Soviet Union in 1990 and the Council for Mutual Economic

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44 The initial aluminum contract launched by Comex in 1983 indeed ceased to be traded in 1989. A second contract was introduced in June 1999.
46 The initial Comex contract was, on the contrary, less informative than all other pricing systems. However, it appears that the second contract, which was launched by the Comex in 1999, successfully competed with the LME contract.
47 This quote from Trevor Tarring, former CEO of Metal Bulletin, is cited in the American Metal’s Market Guide to Steel Futures, available at the following internet address: http://www.steelbenchmarker.com/files/steel_futures.pdf
Assistance (Comecon) constituted a major event which sounded the death knell for the “Six Majors” cartel. During the late eighties/early nineties, aluminum prices fell off the cliff partly because producers from the Eastern bloc were now able to sell their products on the free market. In this context, the ability of the LME aluminum future contract to reflect this new market reality, combined with the high financial pressures faced at that time by the six majors that kept them from absorbing this excess supply, definitively condemned the historical producer pricing system.

Of all the explanatory factors that may explain the demise of the aluminum cartel and the subsequent success of the LME, the surge of the Chinese industry was also a key variable. It is indeed worth remembering that the nonferrous metals industry is a typical energy-intensive sector. In a context of increasing competition amongst producers, Chinese producers, who have both benefited from captive demand and achieved the highest cost/electricity efficiency, are the ones now holding the whip hand48.

48 The energy intensity required to produce one tonne of aluminium has steadily decreased over time, from a world average of 16,951 kWh in 1980 to 14,318 kWh in 2016. According to IAI statistics, China has the lowest energy cost (13,599 kWh), representing a decrease in smelting energy intensity of 18% in less than thirty years (versus a world average of 10%). In the case of aluminum, one of the Chinese government’s main goals was to mothball energy-intensive Söderberg-type smelters, to encourage mergers, acquisitions and vertical/horizontal integration in search for the “optimal industrial size”, and to promote technologically state-of-art plants.
According to the statistics provided by the International Aluminium Institute (IAI), China produced 31,641 thousand metric tons of primary aluminum in 2016 for a world production of 59,890 thousand metric tonnes. However, the Chinese aluminum juggernauts did not just appear from nowhere, and although there are many reasons for their industrial success, there is no ignoring the fact that they have largely benefited from the support of central authorities to promote competitiveness. During the early eighties, the Chinese aluminum industry was indeed grounded in a bedrock of small-scale and rather inefficient producers. Since 1992, the country’s industrial policy has dramatically evolved to spur holistic market-oriented reforms that favored competition between producers and the quest for economies of scale. As underlined by Rock and Toman (2015), the shutdown of small aluminum producers was meant to strengthen SOE competitiveness with both China’s opening-up to world markets and surging local demand as the
main economic backdrop. This surge in Chinese aluminum supply and demand is unequivocally one of the key explanations for the loss of market power experienced by historical producers, but probably not for the overwhelming success of the LME derivatives. The ability of these products to accompany changing market patterns is however worth noting. Despite the launch a similar futures contract on the SHFE, the premiums system developed by the LME to take on board regional market realities, reinforced by the rollout of cash-settlement futures on aluminum premiums, indeed testifies to the fact that the LME reference price system is in for the long haul.

Finally, there is no way we can assert that the financialization of the aluminum industry has been one of the major explanations for the profound transformation experienced by the global aluminum market over the last three decades, but likewise we can hardly argue that this financialization was merely a consequence of a changing market structure. We should indeed recall that hedging with futures ultimately boils down to an arbitrage between a flat price risk and a basis risk, which in turn depends on the level and the stability of the correlation between cash prices and futures prices. In other words, the willingness to properly hedge any short or long physical position through an offsetting position on the corresponding futures market, thus reinforcing the rationale of using the same futures contract, if properly designed, as a reference price for the sales agreement since it ensures, by definition, a stronger correlation between the futures price and the commercial price, and consequently the effectiveness of the hedging strategy. By this same token, financialization should also be understood as a self-reinforcing process.

Since the financialization of iron ore and steel is more recent and certainly at a less developed stage than aluminum or many other base metals, it remains an arduous and maybe premature task to attempt to characterize its impacts on their respective market structure. Akin to aluminum, the market for iron ore underwent a major change in 2010 with a shift from historical annual negotiations between steelmakers and major iron ore producers, to spot prices on a “cost and freight” (CFR) incoterms basis (Astier, 2010). In line with the above mentioned work on LME prices, Wårell (2014) thus attempted to characterize the impact of the new pricing system not on the market structure of iron ore but on its price dynamics. More specifically, the author questions the influence of spot market pricing on iron

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49 The mutation of the Chinese economic model and the resulting lower growth rate of demand for industrial metals observed in 2014 and 2015 somewhat changed this reality and led Chinese aluminum and steel producers to export their surpluses. This has sparked commercial disputes with European countries and the United States. In 2016 and early 2017, the rebound in Chinese demand has eased these tensions.
ore volatility. The studied period spans January 2003 to August 2012 with monthly prices of Chinese imported iron ore fines (62% Fe spot CFR Tianjin port). The author unsurprisingly shows that the introduction of a spot pricing regime fueled an increase in the volatility of iron ore prices. However, when transportation costs are deducted from these imported prices, it appears that the volatility affecting the price of imported iron ore has decreased since the change in the pricing system. Potential volatility spillovers from DCE iron ore futures prices to spot prices are not considered in this study.

Highly concentrated with the “big four” (Vale, Rio Tinto, BHP, Billiton Fortescue Metal Group) being the main producers, the global market for iron ore shows but few common characteristics with the pre-financialized aluminum market that existed in the seventies. The price war that has raged since the price collapse of 2014 and 2015 has shown that there is hardly any room for cooperative strategies and that high entry barriers are still in place. Thus, while the instability of iron prices will probably persist, there is scant probability that the financialization process will move another step forward. In recent years, the DCE future contract has proven to be prone to temporary speculative bubbles whereas its quotation in RMB and the rigidity of delivery conditions have limited its geographical outreach. The divergence in 58% Fe, 62% Fe and 65% iron ore prices, which could increase the basis risk when using a 62% Fe iron ore future contract, should probably also be taken into account to explain the low degree of financialization.
III. Conclusion

This paper is an attempt to disentangle financialization from commodity investing and speculation both from a semantic and a public policy-oriented perspective. We have indeed defended the idea that financialization should be defined in a broad sense, as considered in an industry-focused perspective. By this token, while we do not disregard the very valuable empirical work that has been made to measure the influence of commodity futures markets on cash/spot prices dynamics (volatility), we feel that much remains to be done to consider the nature and the directions of causation between financialization and the evolution of industrial structures. The idea is obviously not to assert that the launch of a new futures contract is a starting point for a profound process of change for the related commodity industry, rather to call for further investigations as to whether this financial innovation might be seen as a catalyst for these industrial and commercial mutations.

We might wonder what the next stages of commodity market financialization might be. As many base or precious metals are already financialized, commodity exchanges may be tempted to experiment with the launch of futures contracts at the upstream stage, as has been done with iron ore or more recently, with alumina. Notwithstanding the LME domination over metal markets, the next major moves may, in this respect, come from Chinese commodity exchanges, whose geographical outreach would undeniably increase if contract specifications were to be more flexible regarding delivery conditions and if the yuan progressively asserts itself as an international currency.
Bibliography


PART III

THE FUTURE
OF COMMODITY
FINANCIALIZATION
CHAPTER 5

From Chicago to Shanghai and Dalian: Apprehending the Future of Chinese Commodity Derivative Markets

Michael Tamvakis

I. Introduction

From the turn of the 21st century, the emergence of China as the powerhouse of world economic growth has been astounding. China is now the world’s second largest economy, behind the United States and has achieved this in less than two decades. Innumerable pages of academic research, economic analysis and political commentary have been produced to evaluate this phenomenon. No matter what the context, there is one word that is always associated with it – commodities.

Whether agriculture, metal or energy commodities, China plays a key role either as a producer, consumer, importer or exporter; occasionally it plays several of these roles simultaneously.

Take iron ore as an example, the world’s largest dry bulk commodity in terms of volume: in 2016 an estimated 2.23 billion metric tons were produced (USGS, 2017), of which 1.49 billion MT were traded internationally, with China accounting for 1 billion MT of global imports. There is no major commodity from any of the main groups – metals and minerals, agriculture and energy – where China does not have some presence, usually a substantial one. Table 1 shows sample commodities and China’s share of world production by volume, and exports and imports by value.
Table 1: Chinese share of production and imports of major commodities

<table>
<thead>
<tr>
<th>Commodity (SITC code)</th>
<th>Production50 (thousand MT)</th>
<th>Export value51 ($ million)</th>
<th>Import value ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron ore (2601)52</td>
<td>825,000 (37%)</td>
<td>&lt;0.5%</td>
<td>57,088 (68%)</td>
</tr>
<tr>
<td>Aluminium ores &amp; concentrates (bauxite &amp; alumina - 2606)</td>
<td>123,500 (86%)</td>
<td>&lt;0.5%</td>
<td>2,526 (64%)</td>
</tr>
<tr>
<td>Copper ores &amp; concentrates (2603)</td>
<td>1,740 (9%)</td>
<td>&lt;0.5%</td>
<td>20,569 (48%)</td>
</tr>
<tr>
<td>Soybeans (1201)53</td>
<td>12,900 (4%)</td>
<td>&lt;0.5%</td>
<td>33,958 (61%)</td>
</tr>
<tr>
<td>Wheat (1001)</td>
<td>128,850 (17%)</td>
<td>&lt;0.5%</td>
<td>801 (2%)</td>
</tr>
<tr>
<td>Corn (1005)</td>
<td>219,554 (21%)</td>
<td>&lt;0.5%</td>
<td>637 (2%)</td>
</tr>
<tr>
<td>Fertilizers (31)54</td>
<td>67,722 (32%)</td>
<td>6,551 (13%)</td>
<td>2,412 (5%)</td>
</tr>
<tr>
<td>Crude oil (2709)55</td>
<td>214,600 (5%)</td>
<td>&lt;0.5%</td>
<td>116,171 (17%)</td>
</tr>
<tr>
<td>Petroleum products (2710)</td>
<td>530,868 (13%)</td>
<td>19,368 (4%)</td>
<td>11,130 (2%)</td>
</tr>
<tr>
<td>Coal (2701)</td>
<td>3,747,000 (48%)</td>
<td>&lt;0.5%</td>
<td>11,486 (13%)</td>
</tr>
</tbody>
</table>

Note: Percentage numbers in brackets indicate share of world production, exports or imports.

Although Table 1 does not provide an exhaustive list of commodities, it offers a glimpse of how important China is, at least on the physical side, for many commodities. It is little wonder then that the country has a keen interest in increasing its participation in the pricing mechanism of at least some of the commodities which are significant for its economy.

The rest of this chapter attempts to shed some light on the development of China’s commodity exchanges, from their birth in the 1990s to their ascendancy to being in the top echelons of commodity derivatives markets globally. We start by casting our eye on the establishment of the main three commodity exchanges and follow with an overview of the key commodity contracts each one lists. We then turn our attention to scholarly research on their performance, especially since the 2000s and we conclude our review with some reflection and discussion on what

51 Data exports and imports are for 2016 and taken from the International Trade Centre (ITC, 2017).
53 Soybeans, wheat and corn production data from United States Department of Agriculture (USDA, 2017).
54 Fertilizer production data (measured as N, P and K nutrients) from the Food and Agriculture Organization (FAO, 2017).
55 Crude oil, petroleum products and coal production data from British Petroleum (BP, 2016).
may lie ahead both for China’s commodity exchanges and the commodities traded in them.

I. A brief history of commodity exchanges in China

In 1978, the Chinese Communist party and its leader Deng Xiaoping launched a series of economic reforms, starting with the “household-responsibility system” in the countryside, which gave some farmers ownership of their product for the first time. Two years later, the southern city of Shenzen became the first “special economic zone”, to experiment with more liberal economic policies.

Public unrest in 1986 was followed by economic turbulence and high inflation in 1988, further anti-government protests in 1989 and culminated in the well-documented events in Beijing’s Tiananmen Square in June of the same year. In 1990, the first ever stock market in Communist China, the Shanghai Stock Exchange, opened. Shortly afterwards and throughout the 1990s several more exchanges, including commodity ones, opened in several Chinese cities, heralding an era of renewed economic growth and focus on market-driven growth. The country greeted the new millennium with accession to the World Trade Organization and the meteoric ascent of the Chinese economy which has incessantly dominated global economic development since then.

In the years following WTO accession, China: sent its first man in space orbit; built the Three Gorges Dam, overtaking Brazil’s Itaipú as the world’s largest hydroelectric dam; hosted the hugely successful summer Olympic Games in Beijing; became the largest automobile producer in the world; became the world’s largest energy consumer and largest electricity producer; and rose past several OECD members to become the world’s second largest economy. This enumeration by no means covers all the milestones achieved by China in the last 15-20 years, nor does it mention the low points and difficulties faced in this path of economic growth. It is an indication, however, of how rapid this growth has been and how important institutional reform must have been to achieve these milestones.

Closer to home with commodity markets was the establishment of the China Securities Regulatory Commission (CSRC) in 1998. The CSRC is a ministerial-level public institution under the State Council which exercises regulatory control over all securities and futures markets in China. It is responsible for: formulating
policies and developing plans for these markets; performing supervisory control of the markets and its officials; supervising the listing, trading and settlement of stocks, bonds and domestic futures contracts; monitoring the overseas futures-related activities of its domestic institutions; and supervising the communication of information and management of statistics pertaining to securities and futures markets. It is as crucial for Chinese commodity derivatives markets, as the CFTC is for the US ones. But what about the commodity exchanges themselves?

1. **Zhengzhou commodity exchange (CZCE)**

   Established in 1990 on a pilot scheme and trading only a forward contract, the Zhengzhou Commodity Exchange listed its first futures contracts in wheat, corn, soybean, green beans and sesame in 1993. Over the years more agricultural commodity contracts were launched and in 2006 the first non-food contract was launched – pure terephthalic acid (PTA - a commodity chemical used for the manufacturing of polyester fibre and PET plastics). This was followed by glass, thermal coal, methanol and ferroalloy; PTA and methanol are currently (early 2017) leading all other contracts by volume, closely followed by rapeseed meal.

   Despite being the first commodity exchange to be founded, the CZCE has lagged the other two and in 2016 it was in third place in China and 11th in the world.

**Figure 1: Volume of Futures Contracts Traded Annually on the CZCE**

![Bar chart showing volume of futures contracts traded annually on the CZCE from 2002 to 2016.](source: FIA, 2017a)
2. Dalian commodity exchange (DCE)

Established in 1993, the DCE initially focused on listing agricultural commodities, including soybeans, soybean meal and corn. In the following year, the DCE was one of the fifteen commodity exchanges which emerged after the consolidation of over fifty smaller exchanges around the country. In 1995, the first long-distance trading system was established in multiple cities throughout China. In 1998, a further round of consolidation resulted in only three major national exchanges – Dalian, Shanghai and Zhengzhou.

Figure 2: Volume of Futures Contracts Traded Annually on the DCE

Source: (FIA, 2017a)

Despite the addition of further agricultural commodity contracts, trading volumes remained modest, until the addition of the first few industrial commodities, such as LLDPE (linear low density polyethylene), PVC and RBD Palm Olein. By the end of 2008, the trading volume had surpassed 1 million contracts per day and by the end of 2012 it was just over 2.5 million contracts per day. The major boost in activity, however, came with the launch of the iron contract at the end of 2013, the world’s first iron ore futures contract for physical delivery. Figure 2 shows the development of trading volume in the DCE since 2001, with notable increase in activity from 2006 onwards and the spectacular rise from 2014 until recently. In 2016, the iron ore and the soybean meal contracts each accounted for nearly a quarter of the total trading volume on the exchange, while the DCE fell to
second place in China behind SHFE and to 8th place on a global basis, with over 1.5 billion contracts traded across all its futures products.

3. Shanghai futures exchange (SHFE)

The SHFE emerged in 1998 after the second round of consolidation of smaller regional exchanges. It was formed from the merger of the Shanghai Metal Exchange, the Shanghai Cereals and Oil Exchange and the Shanghai Commodity Exchange. Trading started with copper, aluminium and rubber. From the outset, metals remain the focus, with zinc, lead, nickel, tin, gold, silver, steel rebar, steel wire rod and steel hot-rolled coil now listed. Rubber remains one of the most actively traded contracts, while fuel oil and bitumen contracts started trading in 2004.

The development path of the SHFE is very similar to that of its other two domestic competitors. Trading volumes started increasing from around 2006 and after an interruption in 2011, they expanded exponentially. In 2016, the SHFE overtook once again the DCE to become the top commodity exchange in China and the 6th in the world. In doing so, it has long overtaken the London Metal Exchange in terms of trading volume. In the next section, we will see how Chinese exchanges have increased their influence in the main commodity groups and how they compare to other international exchanges.
With the help of legislative reforms and institutional changes, under the watchful eye of the CSRC and the immense boost provided by the Chinese economic take-off, the three commodity exchanges thrived and recorded unparalleled growth over the last decade. All three are regular fixtures in the list of the top 30 financial and commodity exchanges. In fact, in 2016 SHFE, DCE and CZCE were 6th, 8th and 11th respectively (see Table 2); this is quite a feat considering that all of them trade in commodity derivatives alone, whereas many of their competitors are driven primarily by their trading in financial products.

There are of course flaws in using a one type of metric versus another. The number of contracts is a consistent measure for comparing trading activity across exchanges, but it does not account for notional quantities of underlying physical assets (which can be important for commodities), nor for their value. In the next section, we look at the three main commodity groups – agriculture, metals and energy – and continue our discussion of the emerging role of China’s commodity exchanges.
Table 2: Top Commodity Exchanges by Volume of Contracts

<table>
<thead>
<tr>
<th>Rank</th>
<th>Exchange</th>
<th>Volume 2016</th>
<th>Volume 2015</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>CME Group</td>
<td>3,942,202,299</td>
<td>3,531,776,304</td>
</tr>
<tr>
<td>2</td>
<td>National Stock Exchange of India</td>
<td>2,119,462,820</td>
<td>3,031,892,784</td>
</tr>
<tr>
<td>3</td>
<td>Intercontinental Exchange</td>
<td>2,037,932,884</td>
<td>1,998,960,757</td>
</tr>
<tr>
<td>4</td>
<td>Moscow Exchange</td>
<td>1,950,145,418</td>
<td>1,659,441,584</td>
</tr>
<tr>
<td>5</td>
<td>Eurex</td>
<td>1,727,766,695</td>
<td>1,672,648,483</td>
</tr>
<tr>
<td>6</td>
<td>Shanghai Futures Exchange</td>
<td>1,680,711,841</td>
<td>1,050,494,146</td>
</tr>
<tr>
<td>7</td>
<td>Nasdaq</td>
<td>1,575,700,250</td>
<td>1,648,958,123</td>
</tr>
<tr>
<td>8</td>
<td>Dalian Commodity Exchange</td>
<td>1,537,479,768</td>
<td>1,116,323,375</td>
</tr>
<tr>
<td>9</td>
<td>BM&amp;FBovespa</td>
<td>1,487,305,788</td>
<td>1,358,592,857</td>
</tr>
<tr>
<td>10</td>
<td>CBOE Holdings</td>
<td>1,184,553,418</td>
<td>1,173,934,104</td>
</tr>
<tr>
<td>11</td>
<td>Zhengzhou Commodity Exchange</td>
<td>901,297,047</td>
<td>1,070,335,606</td>
</tr>
<tr>
<td>12</td>
<td>Korea Exchange</td>
<td>692,990,540</td>
<td>794,935,326</td>
</tr>
</tbody>
</table>

Source: (FIA, 2017b)

II. Overview of commodity contracts traded

The ascent of Chinese futures derivatives markets is clearly attributable to the country’s economic growth since the beginning of the millennium. However, it is also worth emphasizing the increased role of commodity contracts in achieving this. In the last 10 years, between 2007 and 2016, the number of contracts in agricultural, metal and energy commodities increased from 1.16 billion to 5.77 billion (FIA, 2017b, p. 20). This growth in commodity derivatives trading occurred in parallel to a fall in equity index futures; this had the dual effect of maintaining the growth momentum in derivatives trading on a global basis and increasing the share of commodities in the overall volume.

Exchanges such the CME Group and ICE remained in a strong position overall, but Chinese commodity exchanges not only rose in terms of overall trading numbers, but also took the lead in several contracts in the agriculture and metal categories. We look at some of these developments below.
1. Agriculture

The Chicago Board of Trade\textsuperscript{56} was established in 1848 and is the oldest derivatives market for agricultural commodities which still survives today. It is renown especially for its grains and oilseeds contracts and the de facto benchmark setter for reference prices on a global scale. Yet, Table 3 belies this assertion, as the top seven contracts by volume are traded in the DCE, CZCE and SHFE.

There is a straightforward explanation for this – contract size. Take corn for example. The DCE corn contract is for 10 metric tons (MT), whereas the CBOT one is for 5,000 bushels (equivalent to approx. 127 MT). A simple calculation shows that the notional amount of corn traded on the CME in 2016 was 10.87 billion MT, while on the DCE it was 1.22 billion MT. Even when comparing the soybean meal futures contracts of the DCE (ranked 1st) and the CME (ranked 17th), the difference is not as enormous as it seems. The DCE contract is for 10 MT whereas the CME one is for 100 short tons (90.7 MT). The same simple calculation tells us that the notional quantity traded on the DCE was 3.89 billion MT, while on the CME it was 2.35 billion MT; the DCE contract volume is still the leader but only by about 1.5 times.

\footnote{The Chicago Board of Trade is now part of the CME group, which also includes the New York Mercantile Exchange (NYMEX). Including its COMEX division which lists metal contracts.}
Table 3: Top Agriculture Futures Contracts

<table>
<thead>
<tr>
<th>Rank</th>
<th>Contract, Exchange</th>
<th>Volume 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soybean Meal Futures, Dalian Commodity Exchange</td>
<td>388,949,970</td>
</tr>
<tr>
<td>2</td>
<td>Rapeseed Meal (RM) Futures, Zhengzhou Commodity Exchange</td>
<td>246,267,758</td>
</tr>
<tr>
<td>3</td>
<td>RBD Palm Olein Futures, Dalian Commodity Exchange</td>
<td>139,157,899</td>
</tr>
<tr>
<td>4</td>
<td>Corn Futures, Dalian Commodity Exchange</td>
<td>122,362,964</td>
</tr>
<tr>
<td>5</td>
<td>White Sugar (SR) Futures, Zhengzhou Commodity Exchange</td>
<td>117,293,884</td>
</tr>
<tr>
<td>6</td>
<td>Rubber Futures, Shanghai Futures Exchange</td>
<td>97,371,256</td>
</tr>
<tr>
<td>7</td>
<td>Soybean Oil Futures, Dalian Commodity Exchange</td>
<td>94,761,814</td>
</tr>
<tr>
<td>8</td>
<td>Corn Futures, Chicago Board of Trade</td>
<td>85,625,219</td>
</tr>
<tr>
<td>9</td>
<td>Cotton No. 1 (CF) Futures, Zhengzhou Commodity Exchange</td>
<td>80,530,129</td>
</tr>
<tr>
<td>10</td>
<td>Corn Starch Futures, Dalian Commodity Exchange</td>
<td>67,445,264</td>
</tr>
<tr>
<td>11</td>
<td>Soybean Futures, Chicago Board of Trade</td>
<td>61,730,753</td>
</tr>
<tr>
<td>12</td>
<td>Sugar #11 Futures, ICE Futures U.S.</td>
<td>33,115,334</td>
</tr>
<tr>
<td>13</td>
<td>No. 1 Soybean Futures, Dalian Commodity Exchange</td>
<td>32,570,158</td>
</tr>
<tr>
<td>14</td>
<td>Chicago Soft Red Winter Wheat Futures, Chicago Board of Trade</td>
<td>31,059,726</td>
</tr>
<tr>
<td>15</td>
<td>Soybean Oil Futures, Chicago Board of Trade</td>
<td>29,429,298</td>
</tr>
<tr>
<td>16</td>
<td>Rapeseed Oil (OI) Futures, Zhengzhou Commodity Exchange</td>
<td>27,312,246</td>
</tr>
<tr>
<td>17</td>
<td>Soybean Meal Futures, Chicago Board of Trade</td>
<td>25,953,938</td>
</tr>
<tr>
<td>18</td>
<td>Corn Options, Chicago Board of Trade</td>
<td>22,794,484</td>
</tr>
<tr>
<td>19</td>
<td>Egg Futures, Dalian Commodity Exchange</td>
<td>22,474,739</td>
</tr>
<tr>
<td>20</td>
<td>Soybean Options, Chicago Board of Trade</td>
<td>20,109,648</td>
</tr>
</tbody>
</table>

Source: (FIA, 2017b)

The interesting story which emerges from the contract data and their development over the last decade is that all three Chinese exchanges are increasingly active at pricing the various commodities within China, whether the contracts are traded for hedging or speculative purposes. Although one may argue that this price discovery is limited to the Chinese domestic market, it would also be fair to say that domestic prices for commodities where China has a substantial market presence may also provide information signals to other established derivatives markets, such as in the US. We revisit this notion in section 4.
2. Metals and minerals

Historically, international prices for key base metals are set at the London Metal Exchange (LME), which was founded in 1877, not long after the establishment of the Chicago Board of Trade. Its two flagship contracts are for copper and aluminium, both of which are among the top 20 traded metal contracts globally.

In China, while the first contracts to be listed on its commodity exchanges were primarily from the agricultural group, the new millennium brought with it a renewed focus on industrial commodities, especially metals and minerals. As China embarked on its development path, it placed great emphasis on growing its heavy industry. Right at the centre of this strategy are commodities such as steel (and iron ore), aluminium, copper, zinc, nickel, lead, gold and silver.

Although China produces many of these metals and minerals, it also relies on substantial imports to satisfy its demand for construction and manufacturing. As a result, interest in price discovery and hedging increased as the economy took off. It is no wonder that trading in metal futures took off in a major way from the mid-2000s and the main beneficiary of this growth has been the SHFE. As Table 4 shows, five of the six most traded metal contracts were listed on the SHFE, with steel rebar taking the top spot.
## Table 4: Top Metals Futures Contracts

<table>
<thead>
<tr>
<th>Rank</th>
<th>Contract, Exchange</th>
<th>Volume 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Steel Rebar Futures, Shanghai Futures Exchange</td>
<td>934,148,409</td>
</tr>
<tr>
<td>2</td>
<td>Iron Ore Futures, Dalian Commodity Exchange</td>
<td>342,265,309</td>
</tr>
<tr>
<td>3</td>
<td>Nickel Futures, Shanghai Futures Exchange</td>
<td>100,249,941</td>
</tr>
<tr>
<td>4</td>
<td>Silver Futures, Shanghai Futures Exchange</td>
<td>86,501,561</td>
</tr>
<tr>
<td>5</td>
<td>Zinc Futures, Shanghai Futures Exchange</td>
<td>73,065,922</td>
</tr>
<tr>
<td>6</td>
<td>Copper Futures, Shanghai Futures Exchange</td>
<td>72,394,915</td>
</tr>
<tr>
<td>7</td>
<td>Gold (GC) Futures, Commodity Exchange (COMEX)</td>
<td>57,564,840</td>
</tr>
<tr>
<td>8</td>
<td>Aluminium Futures, London Metal Exchange</td>
<td>53,073,441</td>
</tr>
<tr>
<td>9</td>
<td>SPDR Gold Shares ETF Options</td>
<td>52,017,471</td>
</tr>
<tr>
<td>10</td>
<td>Aluminium Futures, Shanghai Futures Exchange</td>
<td>44,391,785</td>
</tr>
<tr>
<td>11</td>
<td>Hot Rolled Coil Futures, Shanghai Futures Exchange</td>
<td>43,281,751</td>
</tr>
<tr>
<td>12</td>
<td>Copper - Grade A Futures, London Metal Exchange</td>
<td>36,947,881</td>
</tr>
<tr>
<td>13</td>
<td>Gold Futures, Shanghai Futures Exchange</td>
<td>34,759,523</td>
</tr>
<tr>
<td>14</td>
<td>Special High Grade Zinc Futures, London Metal Exchange</td>
<td>26,942,407</td>
</tr>
<tr>
<td>15</td>
<td>Gold Futures, Moscow Exchange</td>
<td>22,656,213</td>
</tr>
<tr>
<td>16</td>
<td>Copper (HG) Futures, Commodity Exchange (COMEX)</td>
<td>21,524,547</td>
</tr>
<tr>
<td>17</td>
<td>Primary Nickel Futures, London Metal Exchange</td>
<td>19,947,714</td>
</tr>
<tr>
<td>18</td>
<td>iShares Silver Trust ETF Options</td>
<td>19,338,469</td>
</tr>
<tr>
<td>19</td>
<td>Silver (SI) Futures, Commodity Exchange (COMEX)</td>
<td>18,218,740</td>
</tr>
<tr>
<td>20</td>
<td>Silver MIC Futures, Multi Commodity Exchange of India</td>
<td>14,882,798</td>
</tr>
</tbody>
</table>

Source: (FIA, 2017b)

As with agricultural commodities earlier on, looking only at the number of contracts traded does not tell the whole story, because of the size of the various contracts. For example, the SHFE copper contract is for 5 MT, whereas the LME one is for 25 MT; hence in 2016 the notional quantity of copper traded on SHFE was approx. 362 million MT, while on the LME the respective amount was 923 million MT, i.e. 2.5 times more.

This, however, does not diminish the fact that a substantial amount of price discovery now takes place in China. As with agricultural commodities, although these prices may be reflective of the domestic Chinese market, they provide strong signals to international prices set in other exchanges, considering the major role China plays in the physical trade of these metals and minerals.
3. Energy

Energy has been at the heart of China’s rapid economic growth. The country is the world’s largest producer of coal and electricity and the largest importer of coal and crude oil. While most of its energy is still derived from coal, China is diversifying its energy mix by expanding its capacity in hydroelectricity, nuclear energy, natural gas generation and renewables, such as wind and solar.

Table 5: Top Energy Futures Contracts

<table>
<thead>
<tr>
<th>Rank</th>
<th>Contract, Exchange</th>
<th>Volume 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brent Oil Futures, Moscow Exchange</td>
<td>435,468,923</td>
</tr>
<tr>
<td>2</td>
<td>WTI Light Sweet Crude Oil (CL) Futures, New York Mercantile Exchange</td>
<td>276,768,438</td>
</tr>
<tr>
<td>3</td>
<td>Brent Crude Oil Futures, ICE Futures Europe</td>
<td>210,561,053</td>
</tr>
<tr>
<td>4</td>
<td>Bitumen Futures, Shanghai Futures Exchange</td>
<td>186,814,247</td>
</tr>
<tr>
<td>5</td>
<td>Henry Hub Natural Gas (NG) Futures, New York Mercantile Exchange</td>
<td>97,480,591</td>
</tr>
<tr>
<td>6</td>
<td>Crude Oil Mini Futures, Multi Commodity Exchange of India</td>
<td>67,401,974</td>
</tr>
<tr>
<td>7</td>
<td>Gas Oil Futures, ICE Futures Europe</td>
<td>66,158,348</td>
</tr>
<tr>
<td>8</td>
<td>Crude Oil Futures, Multi Commodity Exchange of India</td>
<td>53,256,420</td>
</tr>
<tr>
<td>9</td>
<td>Coke Futures, Dalian Commodity Exchange</td>
<td>50,461,050</td>
</tr>
<tr>
<td>10</td>
<td>Thermal Coal (ZC) Futures, Zhengzhou Commodity Exchange</td>
<td>50,299,868</td>
</tr>
<tr>
<td>11</td>
<td>WTI Light Sweet Crude Oil Futures, ICE Futures Europe</td>
<td>47,289,665</td>
</tr>
<tr>
<td>12</td>
<td>U.S. Oil Fund ETF Options</td>
<td>46,948,980</td>
</tr>
<tr>
<td>13</td>
<td>Crude Oil (LO) Options, New York Mercantile Exchange</td>
<td>45,879,991</td>
</tr>
<tr>
<td>14</td>
<td>RBOB Gasoline Physical (RB) Futures, New York Mercantile Exchange</td>
<td>45,428,663</td>
</tr>
<tr>
<td>15</td>
<td>Hard Coking Coal Futures, Dalian Commodity Exchange</td>
<td>41,077,427</td>
</tr>
<tr>
<td>16</td>
<td>NY Harbor ULSD (HO) Futures, New York Mercantile Exchange</td>
<td>39,389,349</td>
</tr>
<tr>
<td>17</td>
<td>Brent Crude Oil Last Day Financial (BZ) Futures, New York Mercantile Exchange</td>
<td>23,713,109</td>
</tr>
<tr>
<td>18</td>
<td>Natural Gas (European) (LN) Options, New York Mercantile Exchange</td>
<td>23,520,044</td>
</tr>
<tr>
<td>19</td>
<td>Brent Crude Oil Options, ICE Futures Europe</td>
<td>16,152,414</td>
</tr>
<tr>
<td>20</td>
<td>Natural Gas Futures, Multi Commodity Exchange of India</td>
<td>15,355,328</td>
</tr>
</tbody>
</table>

Source: (FIA, 2017b)

So far, Chinese exchanges have not featured as prominently in trading energy derivatives. In 2016, the largest energy contract trading in China was for bitumen
(a relatively small residual product of the refining industry) on the SHFE. Coke on the DCE and thermal coal on the CZCE were in 9th and 10th place respectively, a reminder that China is the world’s largest consumer of both types of coal. The list was topped by the “usual suspects” – WTI light sweet crude on NYMEX (part of the CME group) and Brent crude on ICE57.

However, China has demonstrated an increasing appetite for oil products, as it is gradually moving to a more consumption-led (rather than export-led) economy, which is typically associated with higher consumption of refined oil products, such as gasoline and diesel oil. In anticipation of this development, the country increased its refining capacity by more than double in the last fifteen years and is now the second largest refining capacity holder after the United States. As oil and gas are likely to increase in importance in the country’s energy mix (the former in transportation and petrochemicals, the latter in power generation and industry), it is only natural to expect an increased desire for a more substantive role in price discovery and risk hedging, at least in the Asia Pacific region.

III. The performance of Chinese commodity exchanges

The emergence and increasing importance of Chinese commodity derivatives attracted the attention of both the business and academic communities, since the early years of the institutional restructuring which led to the creation of the three commodity exchanges. We look at some of the research questions which were posed over the past two decades and some of the results from various investigators.

One of the earlier attempts to document the initial performance of Chinese futures markets is the work of Williams et al in their paper on the mungbean contract listed on the CZCE (Williams et al., 1998). The authors track the strategy followed by the exchange in its initial steps in 1993. They note that CZCE, after establishing a wholesale market in several agricultural commodities, listed only five contracts initially and trading in mungbeans was the one that took off first. The authors then turn their attention to pricing efficiency and the existence of arbitrage opportunities. They cannot draw any conclusion on the relationship between spot and futures prices, mainly due to lack of a full set of data for all wholesale prices.

57 The appearance of Brent crude traded on the Moscow exchange is down to contract size once more. The size of the Moscow contract is just 10 barrels, compared to 1,000 barrels for both the NYMEX and ICE contracts. Hence, the notional quantity of crude traded on the Moscow exchange was 4.35 billion barrels, whereas on NYMEX it was 276.8 billion barrels – approximately 8.5 times the global oil production.
They do, however, observe inter-temporal arbitrage opportunities in 1993-94, which become scarcer or disappear from 1995 onwards. The authors conclude that the evolution of the mungbean contract on CZCE is a good example on how futures market can evolve quite rapidly, in conjunction with a wholesale spot market, without the need for a long and slow process of developing a forward market which can then be formalised into a futures exchange.

Ten years after the establishment of the Chinese commodity exchanges, Chan et al take a closer look at the volatility during this period (Chan, Fung and Leung, 2004). They examine four futures contracts on the three exchanges, over a period of six years: copper (SHFE); soybean (DCE); and mungbeans and wheat (CZCE). Their results indicate that positive and negative returns increase futures volatility, and negative returns appear to have a greater impact on volatility than positive returns. The authors also note that higher volume amplifies volatility, whereas higher open interest mitigates volatility. This is especially the case when looking at data from 1998-2001, when the CSRC imposed more regulations intended to control illegal trading and promote standardized market operations.

A natural progression of research interest in new futures markets is price movement patterns, relationship between futures and spot prices and market efficiency. Wang tackles the issues in two successive papers (Du and Wang, 2004; Wang and Ke, 2005) GARCH, and ARMA models are fitted to the data resulting in the selection of AR(1). Wheat prices go through a battery of standard statistical tests in the 2004 paper, to identify non-stationarity and time-varying volatility. This is followed by fitting AR(1), ARCH(2) and GARCH(1,1) models to the data and comparing results. The authors conclude that the GARCH(1,1) specification is the best overall model, both in terms of goodness of fit and forecasting performance, while also accounting for time-varying volatility and excess kurtosis which is present in the data. The 2005 paper goes on to investigate the efficiency of the wheat and soybean futures contracts on the CZCE and DCE by examining the relationship of futures prices with spot prices from the Zhengzhou and Tianjin wholesale grain markets. Cointegration tests are run between cash and futures prices for six different time horizons from one week to four months. For soybean futures prices, the authors conclude that there is a long-run equilibrium between DCE futures prices and spot prices in Tianjin and Zhengzhou, although the DCE is short-run efficient only with Tianjin spot prices. In contrast, results for the wheat contracts point to a market which was still inefficient at the time, as there was no cointegration between futures and spot prices.
On a similar thread Wang et al look at the efficiency of the SHFE fuel oil contract between 2004 and 2006 (Wang, Liu and Chen, 2007). They perform cointegration tests between the price of the SHFE contract with Huangpu fuel oil prices and check the Granger causality between the two series using a vector error correction model (VECM). The authors conclude that fuel oil futures contract exhibited a highly efficient price discovery function.

Shortly afterwards, Lien and Yang evaluate hedging strategies for the copper and aluminium contracts traded on the SHFE (Lien and Yang, 2008). They start from the basic premise of a stable hedge ratio, which assumes stationary variances for spot and futures returns and a stationary correlation coefficient (naïve hedge). They then move onto a bivariate fractionally integrated generalized autoregressive conditional heteroscedasticity (BFIGARCH) model incorporating a dynamic conditional correlation (DCC) element, which accommodates the time series properties of the data, particularly the long-run relationship between spot and futures returns, long memory volatility, and time-varying variance and correlation of spot and futures returns. Finally, their model equations incorporate asymmetric basis effects, i.e. adjustment speeds to restore the long-run equilibrium relationship when the futures market is in contango differ to those when the market is in backwardation. The authors compare the performance of the various models when constructing hedge portfolios for both aluminium and copper and conclude that the asymmetric BFIGARCH model outperforms all other models in the case of aluminium, but there is no clear winner in the case of copper.

So far, we can observe that the study of Chinese commodity exchanges has followed a well-trodden path: initially it is about how well the market is established, how it functions and how well it communicates with the spot market; the focus then moves on examining price behaviour, both in terms of returns and volatility; finally, the long-run relationship between spot and futures prices is tested alongside the hedging effectiveness of the latter.

As the Chinese futures markets became more established, grew in popularity and size and offered a robust platform for domestic price discovery and hedging, the research discourse moved on to the linkages with international commodity exchanges and the flow of price information (on returns as well as volatility) for specific commodities across futures markets.

Among the first to tackle this topic are Hua and Chen who investigate market linkages for four commodities from the metal and agriculture group (Hua and
Chen, 2007). They use an array of standard tools, including cointegration tests, error correction models, Granger causality tests and impulse response analysis. They apply these to futures contracts for copper and aluminium (SHFE and LME), soybeans (DCE and CBOT) and wheat (CZCE and CBOT). They find long-run relationships for the copper, aluminium and soybean contracts, but not for the wheat contract. In the case of the three cointegrating contracts, they find that overseas exchanges (LME and CBOT) have a greater influence on their Chinese counterparts (SHFE and DCE, respectively), but there is also flow of information in the opposite direction.

Metal futures are again the focus of Fung et al who study copper and aluminium contracts listed on the SHFE and NYMEX between May 1999 and May 2009 (Fung, Liu and Tse, 2010). They identify structural breaks for both metals (as expected) and confirm that futures prices for each metal are cointegrated across the two markets. The authors then proceed to run a VECM which indicates that there is a bi-directional error correction process between Shanghai and New York, with the US market being more informationally efficient than the Chinese market.

Using a VECM-GARCH framework, Liu and An study information transmission, price discovery, lead-lag relationships and volatility spillover effects for copper and soybeans, using Chinese spot prices and SHFE, NYMEX and CME Globex futures prices, for a sample period between January 2004 and December 2009 (Liu and An, 2011). The authors conclude that: Chinese futures, spots, and US futures are cointegrated with one common stochastic factor; there exist bi-directional, but asymmetric, lead–lag relationships between Chinese futures and spot markets, as well as between Chinese and US futures markets in terms of information transmission; and US futures markets lead Chinese futures markets, which in turn lead Chinese spot markets in the short-run.

The cross-market linkage between the DCE and CBOT is revisited by Han et al who use SVAR and VECM to investigate soybean futures prices during trading and non-trading hours (Han, Liang and Tang, 2013). The authors use data between March 2002 to September 2011 to construct continuous price series for the two contracts and they calculate returns both for trading hours (open-to-close) and non-trading hours (close-to-open), given that the trading session of the two exchanges do not overlap. Their results reconfirm that there is a long-run cointegration relationship between DCE and CBOT futures prices and that CBOT prices significantly affect DCE ones. However, they also find evidence that the DCE also has a significant impact on CBOT and the magnitude of both
impacts is similar, leading to the conclusion that the DCE is playing an important role in the global price discovery of soybean futures.

Building on earlier work by Li and Zhang who identified a long-run relationship between the copper futures contracts trading on the SHFE and LME (Li and Zhang, 2009), Kang and Yoon examine the relationship between the SHFE and LME futures contracts for aluminium, copper and zinc (Kang and Yoon, 2016). They use a generalised VAR methodology, variance decomposition and the Diebold & Yilmaz spillover index model (Diebold and Yilmaz, 2012) on a data sample from August 2007 to April 2016. The authors find that LME has a greater impact on SHFE futures returns and volatilities and that the dynamic spillover trends are more pronounced in the aftermath of the global financial crisis.

Finally, Fung et al expand on previous work on international linkages between Chinese and several other commodity exchanges (Fung et al., 2013). The authors use data for 16 contracts of agriculture and metal commodities trading on the SHFE, DCE and CZCE, between December 2003 and October 2011. The contracts range from soybeans, rice and natural rubber, to copper, zinc and palm olein. They then match them with equivalent contracts from several other exchanges including the LME, EURONEXT, CME, TOCOM\(^{58}\), ICE and MDEX\(^{59}\). The analysis concentrates on returns and it distinguishes between close-to-close, open-to-close and close-to-open (non-trading) returns where appropriate. Results on the trading and non-trading returns analysis show that overnight changes in the Chinese futures returns are significantly driven by relevant information released during the daytime trading hours of the corresponding US/UK market. The authors’ analysis of results on the open-to-close returns indicates that the Chinese market leads the US market in cotton futures, while the Malaysian market leads the Chinese futures market in daytime returns of palm olein futures contracts. The authors conclude that most futures contracts in the sample do not exhibit a lead-lag relation between markets and the overall results show that the Chinese and foreign markets are information-efficient on a daily level.

\(^{58}\) Tokyo Commodity Exchange.
\(^{59}\) Malaysia Derivatives Exchange.
IV. Looking ahead

The establishment of organised commodity exchanges in China was revolutionary for a country with a long-established, centrally-planned economic system. The recognition that markets and private enterprise, albeit with government supervision and moderation, can be the engine of growth was the starting point in China’s modern economic history.

Since 1993, the process has become more evolutionary and the review of scholarly research follows this evolution. Chinese commodity futures markets followed the well-established “playbook” of other commodity derivatives markets, especially those in the US. The process started with the establishment of a strong regulatory authority and robust wholesale markets in key commodities, initially in agriculture. This was followed by listing a small number of futures contracts and gradually increasing the offerings with commodities which assumed greater importance in the Chinese economy. As results from academic research indicates, futures contracts are efficient in price discovery and hedging and exhibit long-run cointegration with respective spot prices. As Chinese commodity exchanges increased in stature and ranked highly in the lists of top global futures markets, they attracted more interest in terms of their contribution to the global price discovery of certain commodities and their relationship with mature futures markets which have traditionally produced price benchmarking. Existing research suggests that there is a bi-directional influence between contracts listed on the SHFE, DCE and CZCE and their counterparties on other international exchanges and that this influence may be of similar magnitude, i.e. Chinese commodity exchanges could be equally important in setting global prices for some commodities.

So what next? Ahead lie opportunities, as well as challenges. As China continues to embrace open market economics and the risks associated with this, it will need to consolidate and expand the derivative markets which provide the tool to mitigate these risks. In the words of the Chairman of the DCE “We [in China] are behind international markets because we have too few tools, too few products” (Hornby, 2017). To do this, there is a need to extend the range of available instruments, both in terms of commodities covered (e.g. crude oil, natural gas, fertilizers, etc.), as well as the types offered (e.g. options, swaps and so on).

Now that Chinese exchanges have a closer informational linkage with other international exchanges and China has such an important role as a consumer of many raw materials, there is a stronger desire to play a larger role in setting global
commodity prices. For this to happen, the Chinese market needs to be more than a large, but isolated, domestic market. In a recent interview, the vice-chairman of the CSRC said that “China’s commodities market should be opened to offshore investors”. He added that “the country would look to start doing so in products such as crude oil, iron ore and rubber” and “the regulator is also examining allowing banks and other financial institutions to enter the market” (Lian and Goh, 2016).

As welcome as this may be, there must be an element of apprehension by potential overseas market participants, especially in view of the apparent rush of Chinese speculators who inflated prices in 2016, before the CSRC stepped in to increase fees and margins and limit the number of new positions allowed on a daily basis (Ritchie and Zhu, 2016; Sanderson, 2016; Cang, 2017). The regulator intervention may of course be necessary, but it may also bring unease to existing and potential new market participants, such as western banks and trading houses, who are more comfortable dealing with exchanges where the rules are more constant (Russell, 2016).

China has come a long way from an isolated, closed and largely agrarian economy, to a modern economic powerhouse, driven by manufacturing and exports and moving towards a more ‘western-style’, consumption-led economy. Commodities remain central to its economic growth in the future, whether agriculture, metal or energy goods. As China continues to play a dominant role in the production, consumption and international trade of many of these commodities, its involvement in pricing and risk management is unlikely to diminish. Challenges do exist and will require careful planning and mitigation. In doing so, Chinese authorities will benefit from giving access to commodity derivatives markets to overseas participants and strengthen their role in global price setting.
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The Financialization of Commodity Markets: A Short-lived Phenomenon?

Commodities are at the very heart of economic activity. From oil to wheat, from aluminum to coffee or rubber, we are all, in one way or another and to varying degrees, dependent on commodities. Different in terms of their physical properties but governed by common economic mechanisms, traded on global and oligopolistic markets, subject to intense competitive pressures and speculative bets, often marked by highly volatile prices, objects of geopolitical rivalries or cooperatives strategies: commodities are certainly products unlike any other in the economic world. It is therefore essential to understand not only the mechanisms governing their price formation, but also the profound changes which affect their markets. From this point of view, the financialization of commodity markets, defined both as the boom in commodity investment funds during the so-called “commodity super-cycle”, and the increased role played by financial derivatives markets in commodity industries, is a major economic development that needs to be analyzed extensively. This is the ambition of this book. Written by recognized experts from the academic world or major international institutions, it aims to explore the different facets of this complex and often misunderstood phenomenon. What role can futures markets play in determining commodity prices? How have they evolved in modern times? To what extent has speculation shaped the commodity super-cycle? How can we understand that some commodities have known this financialization phenomenon for a very long time while others have not? Are there any significant differences in the way commodity industries, whether agricultural, metal or energy, become financialized? Finally, if we accept the idea that financialization is part of an irrevocable process, what forms could it take in the years to come? These are among the many questions addressed here which make this book a new and useful contribution to public debates.