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# Fertilizers Markets: In Search of the Index of Choice

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## **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

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## **Introduction**

Commodity markets usually have greatest liquidity in Futures markets rather 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.

## **Section 2 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.

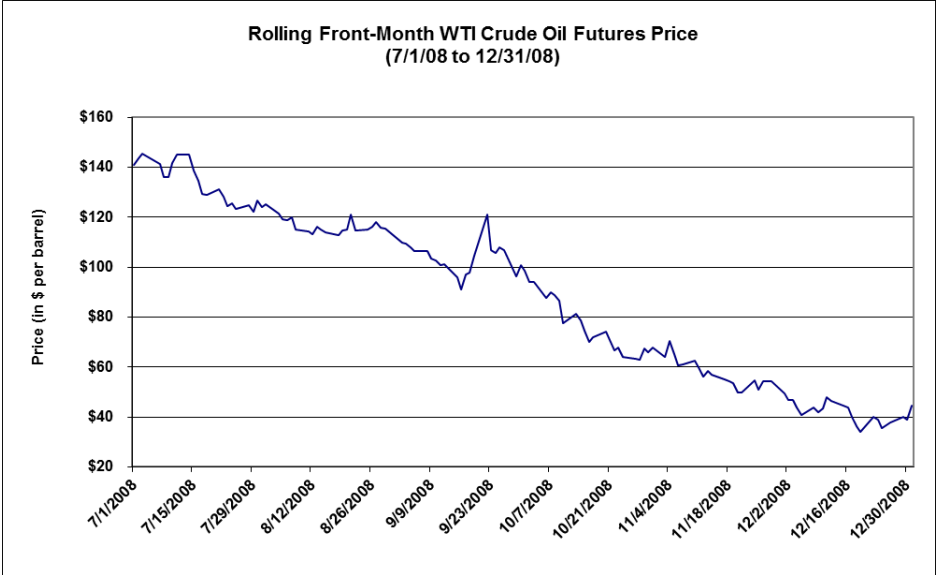


Figure 1: The Rapid Decline in Oil Prices over the second half of 2008

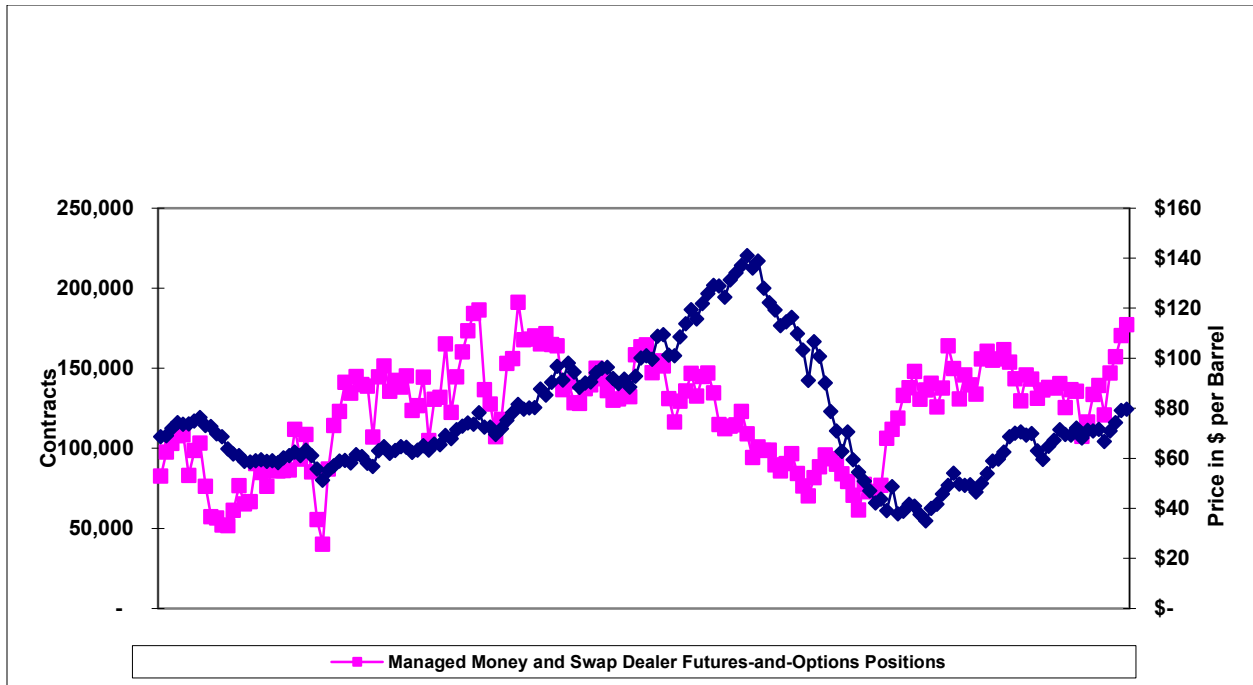


Figure 2 Positions of Non Commercial Players (From COT) versus Oil Prices over the period 2006 to 2009

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  $t = \text{Feb 4, 2015}$ , sell a Future contract maturing in one year for instance ( $T = t + \text{one year}$ ) 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

$$F(t, T) - S(t) [ 1 + r (T - t) + c (T-t) ]$$

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.

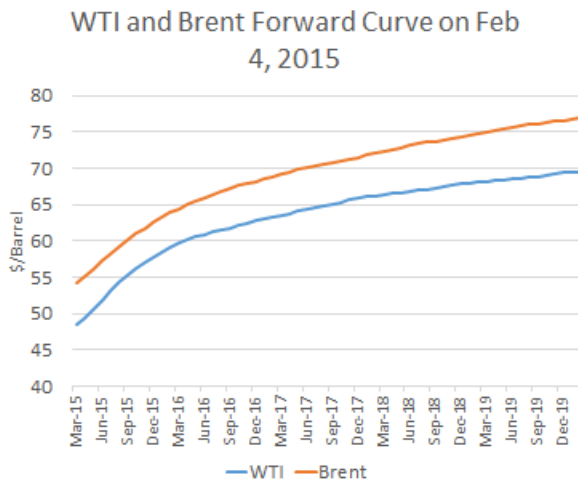


Figure 3 : WTI and Brent Forward Curves on Feb 4, 2015

Despite the so-called ‘financialization’ of the markets, the buyers of crude oil 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 in an arbitrary space and the limits of ‘carry trade’, are dictated by the physical constraints. . Storage may take place today 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.

### *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.

## Corn vs Wheat

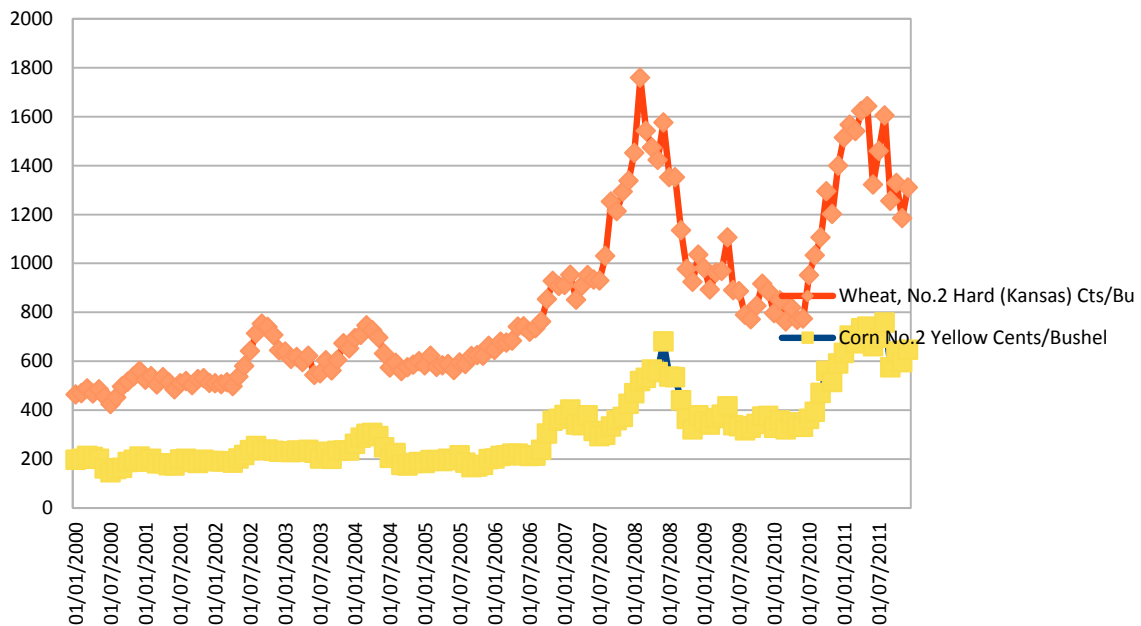


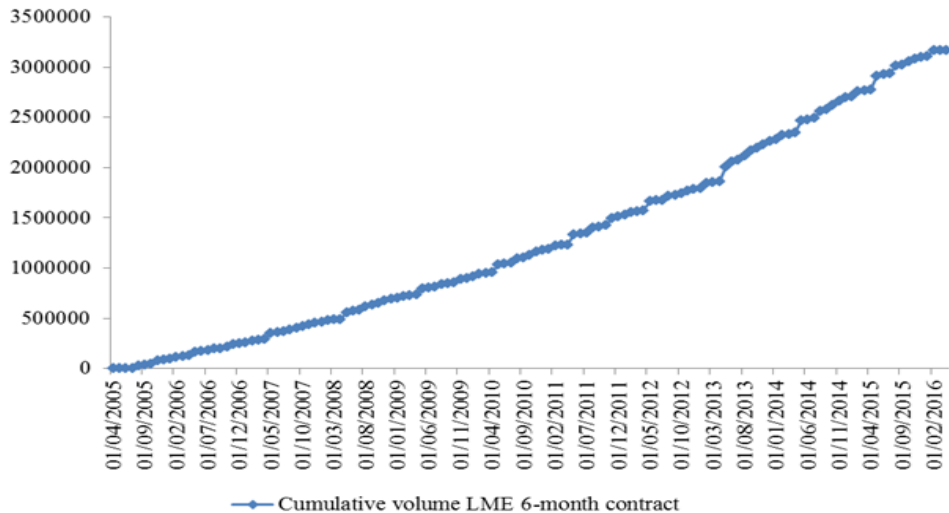
Figure 4: The Spike in Wheat and Corn Prices in 2007/2008

### *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.





### *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 inventories. 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 ever-preeminent 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 WTI index has been exhibiting during the year 2017 large moves up (and down) upon the announcement by the US Department of Energy that inventory had decreased more (or less) than expected by the consensus.

### **Section 3 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 of their transaction.

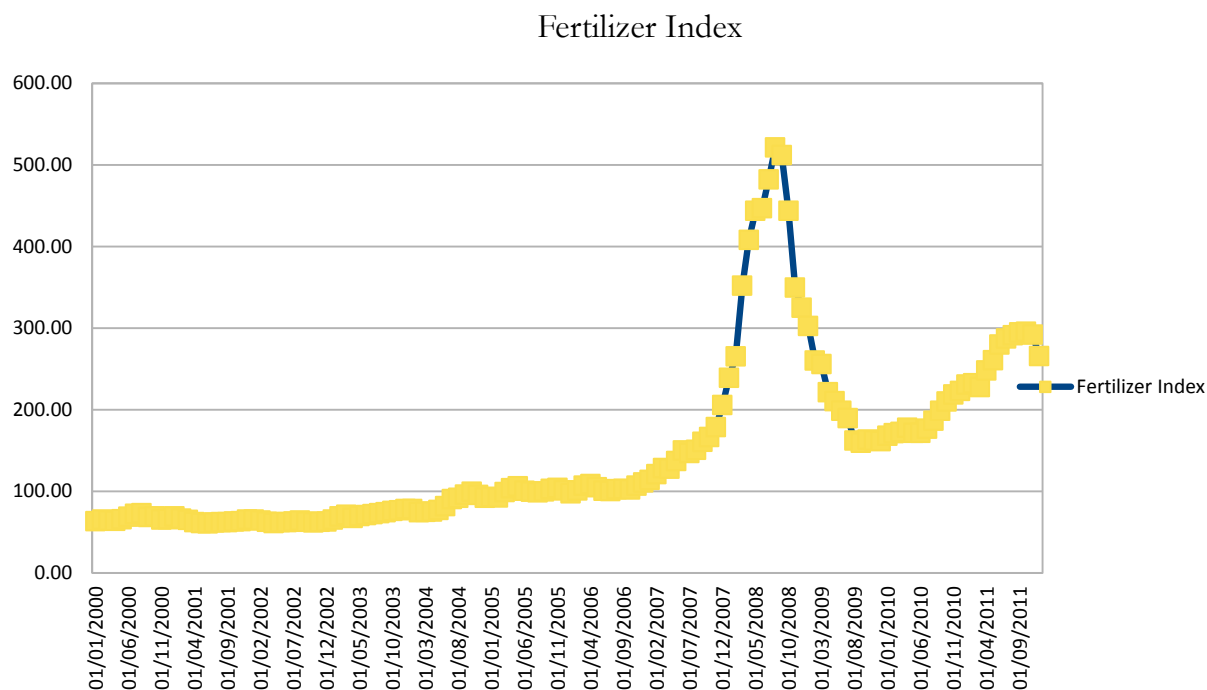


Figure 6 The Spike in Fertilizer Prices in 2008

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.

#### *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.

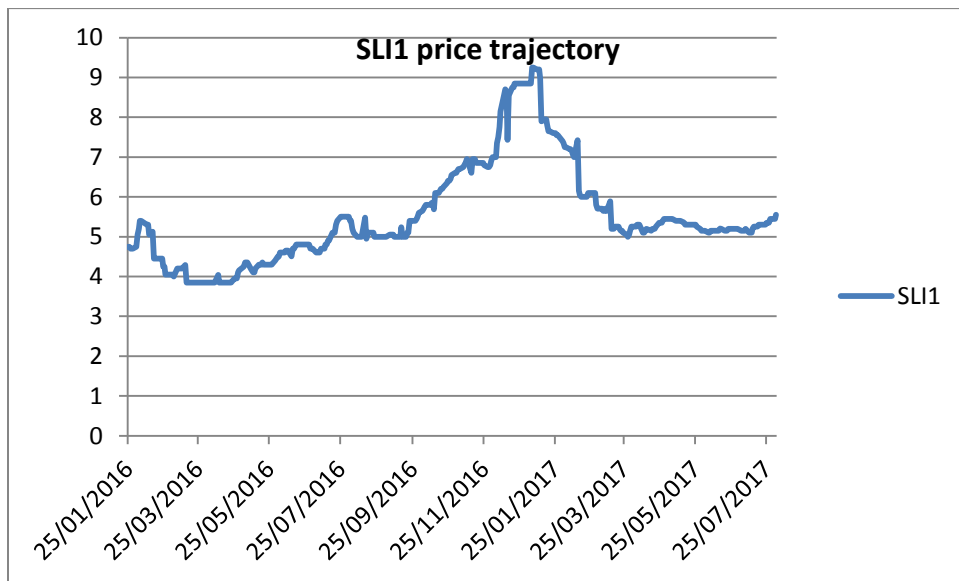


Figure 8 Sling Price trajectory starting in Jan 2016

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) wants 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.

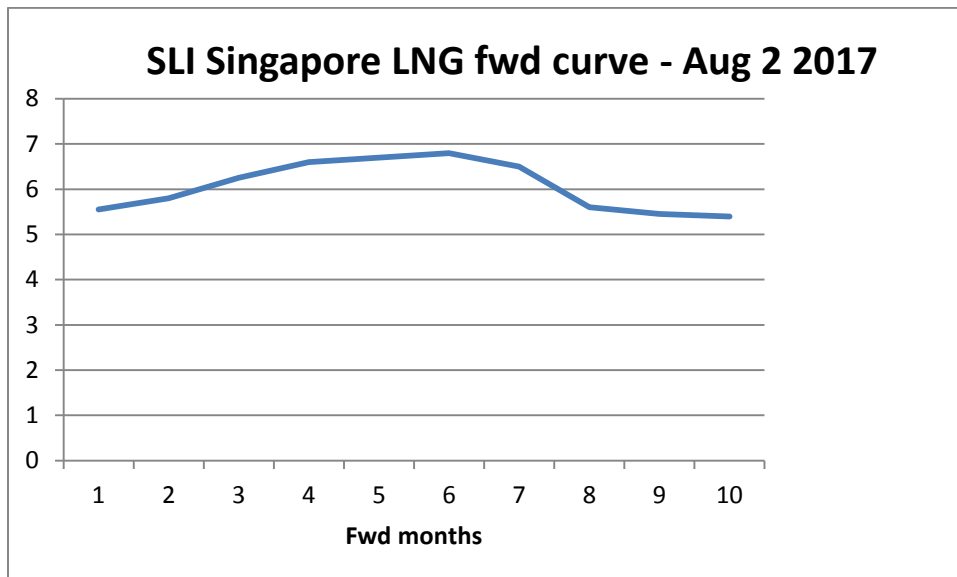


Figure 9: Sling Forward Curve on Aug 2, 2017

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 m<sup>3</sup>. 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 that Exchanges are competing for.

#### **Section 4 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, paving the way to Futures contracts trading.

For natural gas, launching derivatives and establishing a Clearing venue for swaps and Futures is the subject of a fast competition between established Exchanges like the Chicago Mercantile Exchange, and new ones like the Singapore Exchange – the latter being located in the part of the world where the demand for LNG is exploding. In contrast to iron ore where the move was decided by the producers /mining companies, Exchanges are taking the lead here. And the choice of the preferred underlying for derivatives is taking place among a number of competing indexes, as commodity pricing benchmarks represent a ‘winner-takes-all’ game. The information provider, Platts, has been a respected name in the oil markets for decades and used its credibility in the establishment of the Japan Korea Marker (JKM) Platts has been publishing for a few years. The index was readily available and visible when the large volumes of LNG imported into that region of the world naturally led consumers to search for hedging instruments.

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 a reputation among farmers and co-operatives in order to bring this large number of natural players into the space of fertilizer derivatives trading.

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