



THE COMMODITY SUPERCYCLE 2002-2008

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0. SUMMARY

The purpose of the following paper is to study the supercycle of commodities that occurred during the years 2002 and 2008, as well as to give a vision of the supercycles throughout the last century, the causes of the increases in the price of commodities, the determinant factors of prices and if these increases in prices are mainly due to economic components or are due to a speculative phenomenon.

After giving this general vision of the subject, an empirical analysis will be conducted on the last supercycle of commodities and its possible relationship with the financialization of the commodity markets. The commodities that are analysed are a total of 12 belonging to 4 groups: agricultural products, soft materials, energy and metals. The conclusions we reached are that although much of the variation in the prices of commodities can be explained through the hypothesis of supply and demand, there is enough evidence to believe in the hypothesis of price manipulation, not only through an analytical demonstration but also through the actions taken by the regulatory body that controls the proper functioning of commodity markets, since there are numerous economic sanctions that punish price manipulation in the commodity markets.

1. INTRODUCTION

The recent global economic crisis was preceded by an unprecedented commodity price boom regarding its magnitude and duration. Real energy and metal prices more than doubled in five years, from 2003 to 2008, while the real price of food products increased a 75%. This has led some authors to consider this period as a commodity supercycle. A commodity supercycle is understood as a prolonged period where prices are well above their long-term trend.

A supercycle is different from a short-term increase because of the duration of the expansion period. This first period of expansion exceeds a decade, and the entire period of expansion and recovery of levels exceeds two decades (Cuddington and Jerrett, 2008). On the other hand, it is observed in a wide variety of products.

The generalized method of detecting a supercycle is the one developed by Christiano and Fitzgerald (2003), known as the “band pass filter”. This method identifies price fluctuations and generates trends in prices between 20 and 70 years. The “band pass filter” is the calculation by which the trend line that generates long-term cycles is estimated. The “band pass filter” identifies the points where the prices of commodities should be if the markets follow the long-term trend. For the comparison, it would be

necessary to generate another line that allows eliminating short-term price deviations by creating a medium-short-term trend line and comparing them with each other.

During the 20th century, three periods of outstanding price increase have been observed in the market of commodities (Radetzky, 2006):

The first period with a great growth in the price of commodities is between 1949 and 1952, after the end of the Second World War and the start of the Korean War. During the Korean War, due to the painful experience of the Second World War, agricultural and mineral goods are stored generating a climate of accumulation and generating a purely speculative demand. The prices of agricultural raw materials and food had a more significant peak but remained constant after that. In fact, in these cases of agricultural products, after realizing that the conflict would not spread in a way that affected the whole world, prices would soon fall to normal pre-boom levels. In the case of metals and energy, they would not return to previous levels and there is not an excessive growth despite the growth of the industrialized countries.

The second period with great growth in commodity prices is the one observed between the years 1972-1974 and it is much more extreme due to inflation since it increased extremely high by more than 75%. The first sign of high growth, as in the previous cycle, can be seen in the growth of food prices. Economic growth, along with periods of bad harvests and little food storage, created a period of food shortages that led to an increase in the price of food in the first place. This takes place at the same time than the great oil crisis after OPEC's decision of not supplying energy to Western European countries and the US. Due to the empowerment of the oil cartel (OPEC), who was in charge of deciding on the supply and price of oil, the 1973 oil crisis was generated through the paralysis of the supply of some of the producing countries. From this moment on, a great shock is generated in the prices of energy-related raw materials. On the other hand, this shock produces a contagion effect on metal prices, since it was the only commodity market in which prices were kept relatively constant. On the other hand, the continuity of the growth cycle in the rest of the commodity markets is more evident.

The third cycle, like the other cycles, is preceded by a rise in the price of food and agricultural products. Due to the economic expansion of 2004, the demand for oil increased considerably from 2000 to 2005. In the same way, the demand for metals grew doubling their price between 2002 and 2005. The growing demand from emerging countries and their economic growth would explain this rise. It is remarkable the growth in the price of energy and metals, doubling the prices. On the other hand, in the case of agricultural and food products, growth is less pronounced.

In this paper we focus on analyzing this latest supercycle of commodities and its possible relationship with financialization in the commodity markets, analyzing the causes of this growth, the hypotheses that explain this growth and its demonstration. Mainly for the analysis of the supply-demand hypothesis, we will conduct a correlation analysis, demonstrating the relationship that exists between the increase in prices of raw materials and the reduction or increase in global GDP. On the other hand, to analyze the hypothesis of speculation in commodity markets, we will analyze the profile of investors who participate in the commodity futures contract market (since it is the largest market where these products are traded) according to the methodology followed in Chari and Christiano (2017) and we will distinguish between those that have a purely commercial interest, or have a speculative interest instead.

2. CAUSES OF SUPERCYCLES: WHAT DOES THE PRICE OF COMMODITIES DEPEND ON?

2.1. HYPOTHESIS OF THE SUPPLY AND THE DEMAND

This hypothesis assumes that the price of commodities is determined from the intersection between the supply and demand curves. Faced with any increase in demand, there will be an increase in prices consequently. This would a priori be the basis on which the price increases in commodities will be sustained. As an explanation to the 2002-2008 supercycle, it could be shown that the increase in demand from emerging countries (countries that experienced greater economic growth), led to the increase in prices of commodities during the 2002-2008 period.

2.1.1. APPROACH IN AGRICULTURAL PRODUCTS

The supply and demand hypothesis states that the price of raw materials depends only on the equilibrium price set between the supply and demand curves. Therefore, the producer is able to generate higher revenues the higher the equilibrium price is. This is not done immediately but it takes time to adjust the price and the quantity produced by the agricultural producer, since he will adjust his production by analysing the prices of the previous harvest in what is called the cobweb theorem, as Mackey (1988) explains.

According to this theorem, the producer adapts the quantity to be produced by analysing the last selling price. If he previously sold a large quantity at a low price, the same producer would reduce the quantity produced to maximize profits. After this period, by creating scarcity and in this way having greater unit profits, when he realises the increase in prices, he will seek to increase the quantity to be produced to obtain more

benefits. Producers, attracted by this price increase, will produce more with the aim of selling at the same price. Seeing that they cannot sell at the previous price, they will lower prices, thus returning to the starting point.

One limitation of this model is that it does not consider the variable “storage time”. We can understand that the most beneficial thing for the producer is to sell when the equilibrium price is high and to minimize the storage time in case of low prices, drawing a storage curve inversely related to the price level: the lower the price, the higher the storage time, so the process is affected by the delay in the production and the one that the storage itself entails. The Mackey model (1988) carries out a study on the price of raw materials going beyond the cobweb supply and demand model itself, adding the “storage” factor as an extra variable to the delay in production. Considering that the delays produced may potentially destabilize prices, this study establishes that a period between two to four times the storage time in equilibrium is necessary. This is conducted in a market for highly accepted products with a price elasticity of supply greater than the price elasticity of demand. In this way, it is shown the hypothesis where the producers themselves can stabilize an a priori unstable market or destabilize an a priori stable market.

2.1.2. GROWTH OF EMERGING COUNTRIES

The high economic growth coming from emerging countries during the 2002-2008 period, such as China, generated a shock in the demand for raw materials due to this growth (Jerrett and Cuddington, 2006). Starting with the demand for metals and generating an increase in the prices of other raw materials, it affected in a greater way because sudden changes in the supply of metals and energy are much more difficult to adjust. For example, a petrochemical plant or an underground mine requires projects between 5 to 6 years, which make the supply of these commodities quite rigid. Therefore, metals and energy will have longer cycles (Majd and Pindyck, 1987) and agricultural products will have shorter cycles. In metals, the maturation time of the technology also differs considerably from the agricultural sector, as well as the predictions in growth. The process of growth, construction and industrialization in emerging countries determines the growth in demand for metals.

During the 2002-2008 supercycle there is also an increase in the demand for oil in China, the US and in the world. According to a study by the Energy Information Administration, (Eckaus RS, 2008) China achieved an increase in consumption of more than 15% in 2004, while growth in the world economy and the United States during the

same year did not exceed 5%. This growth in China could explain the higher demand for materials and, depending on their price elasticity, the impact on the price of commodities could be higher or lower.

Erten and Ocampo (2012) analyse more specifically this aspect and compare the evolution of GDP with the growth of commodity prices, as well as the correlation between them. These authors observe that there is a direct correlation between the prices of commodities with each other and between the GDP of the countries during the last supercycle. The correlation between commodity prices and global production indicators is quite large, as indicated by the Pearson's correlation coefficient of 0.53 between commodities and GDP in OECD countries, and 0.58 between commodities and the world GDP. These figures rise to 61% and 73% when we look exclusively at metal prices. Furthermore, the correlations for the world GDP series are much stronger than those for the OECD GDP index. The biggest difference is for oil correlations with production indices: 0.19 for OECD GDP and 0.46 for world GDP¹. What we can conclude from this study is that there is a relationship between GDP and the price of commodities. The most striking relationship could be the one between metals and GDP. Almost all metals show a correlation coefficient higher than 0.55 with GDP. This goes back largely to the first commodity boom, where price growth took place first in the metals market and later in the rest of commodity markets (Radezky, 2006).

2.2. HYPOTHESIS OF PRICE MANIPULATION AND SPECULATION

One of the concepts that has been on the forefront during the 2002-2008 commodity supercycle is the one referring to the financialization of the commodity markets. Financialization is understood as the increasing influence of financial markets on the national and international economy. This process spreads mainly over the last two decades of the 20th century. This process developed a structural change in the number of financial transactions, real interest rates, financial profitability and participation in gross national income as opposed to trade and real goods markets. In this way, we move from an economy based on conventional markets to an economy based on investments and financial transactions. In fact, the companies based on these instruments are the ones having the highest profits. Similarly, ownership of financial assets as part of the total income of people (understanding financial assets as the transfer of capital in order to receive future interests, dividends or benefits in exchange) shows the same trend. This, on the other hand, has contributed to inequality since it has

¹ This study considers that a coefficient of 1 would be a perfect correlation and a coefficient of -1 would be a perfect and inverse correlation while a coefficient of zero means that the two variables are totally uncorrelated to increases or decreases.

changed investment based on productive activities to investment based on financial activities, contributing to the reduction of real wages, lower purchasing power of the middle and lower classes and increasing indebtedness and inequality [Pimentel, 2008; Steinberg, 2008].

This process of financialization of the economy occurs together and interdependently to the globalization process and it emerges from the most developed countries creating an economy based on increasingly immense and global financial markets. The process of financialization of the economy has also affected the commodity markets. As the article by Finance Watch (2002) indicates, the volume of commodity markets becomes, between 1998 and 2008, from being a market where physical products predominate (77% of the market compared to the rest, 16% for traditional futures market and 7% for index investors) to being a market where the index investor grows into the largest of the agents only 10 years later (becoming 41% of the volume of the commodity market while the market of physical goods now has 31% of the total volume, reducing its relative weight by more than half. The futures market represents 28%, increasing its weight in the market by almost 50%).

When we talk about commodity markets, we are talking largely about the futures market. This market negotiates the future purchase of a certain amount of raw materials at a certain future time. Similar to most financial instruments, there is a higher profit margin the later the future contract expires. Therefore, in order to maximize profits, long positions will be more convenient. Furthermore, if the prices of raw materials increase in the future, producers will set their spot prices according to future profitability. Therefore, valuing the cash contracts upwards will both increase current profits and favour upward expectations. With this example, and only taking into account the futures market on physical raw materials themselves, we can see a price speculation with financial instruments that have a direct relationship to the price of raw materials.

In addition, the appearance of new markets and different deregulation laws lead to a process of total financialization of the economy. Many of the movements in OTC markets have no direct relationship with the raw materials at source but are contracts whose underlying correspond to raw materials. As Michael W. Masters (2008) explains in the investigation commission of the 2008 financial crisis, the crisis within the commodity markets arises, first, through laws in order to liberalize and deregulate derivatives markets, regulations that emerged between 1980 and 2000, causing volatility and speculation and allowing distributors to obtain greater profits. They take advantage of the privileged information provided by being the distributor itself and also allow them

to hedge risks with those clients who have opposite positions. And if it was not possible to cover the totality of the positions, the distributors would make use of regulated or futures markets. For this reason, for the risk diversification itself, financialization had a direct effect on the commodity markets that generated a total market instability. The lack of a clearinghouse for the derivatives markets, the distrust of the counterpart due to the leverage in investments, and the lack of credit, would generate an upward trend in the prices of raw materials according to Masters (2008).

In the current configuration within the commodity futures market, the investor index has special relevance, where investors do not have futures contracts but instead invest following the market's trend. The index investor takes long positions, buys and holds without looking at the price, and assigns percentages of his portfolio to each commodity, in order to hold and sell higher in a generalized way. During the 2000s there was a collapse in the stock market (due to the dot-com crisis) where the commodity market does not match the fundamental price. The OTC or unregulated markets became supported by futures markets where futures contracts were bought in proportion to their importance in the index. Upward expectations encouraged converting physical offers into futures contracts with dates beyond expiration. The depreciation of the dollar, the growth of China and India, the boom in biofuels and the manipulation of inventories generated a boom of index investors with continued gains in price.

In fact, the relative weight of investments in raw materials totally reverses the traditional trend of physical investment towards the price index. Masters (2008) indicates a great tendency towards speculation: from the investor in futures to the physical purchase of contracts towards a merely speculative index that totally differs from the physical market. The percentage of speculation is multiplied by 2 in the least affected markets in just 10 years, but in the most affected markets the percentage of speculation is multiplied by 7. These changes in the commodity markets are directly related to the trend towards investment in indices, neglecting investment in underlying assets.

The importance of financial transactions in the commodity markets also occasioned attempts of price manipulation, carried out by purely speculative reasons. The Commodity Futures Trading Commission (CFTC) confirms numerous complaints to different companies between the decade of 2000 and 2010 in which such price manipulation is manifested.

Since 2000, according to the CFTC, the following sanctions have been imposed in all types of commodity markets, but especially in the energy market.

In the case of electricity, on August 21, 2001 Avista Energy was fined for manipulating the price of electricity futures. This is followed by a large number of energy markets.

On the other hand, in the case of gas in 2002 Dynegy Marketing and Trade and West Coast Power LLC received a \$ 5 million fine for manipulating natural gas pricing and reporting. During 2003 and early 2004, many companies were sanctioned for the same reason. In 2006 and 2008, BP was sanctioned for manipulating the price of propane with a fine of 303 million. In 2007, the CFTC sanctioned Amaranth and Energy Transfer Partners, for price manipulation and falsification of statements to the mercantile stock market in this same market. The last sanction notified by the CFTC is the one imposed on Total Gas & Power North America, Inc. for manipulation in the monthly price index.

In the case of the oil market, in 2008 Optiver Holding was sanctioned for manipulation and attempted manipulation in crude markets and ConAgra Trade Group, Inc. (CTG) for the same reason. In 2010 Parnon Energy Inc., Arcadia Petroleum are penalized for cross marketing manipulation, accumulation and substantial sale.

On the other hand, for precious metals in April 2010 Moore Capital Management, LP and affiliated companies were sanctioned for price manipulation in platinum and palladium futures. For this same reason the company MF Global Inc was sanctioned in March 2012.

In the case of the agricultural products market, in December 2012 Eric Moncada, BES Capital LLC and Serdika LLC were sanctioned for manipulating futures prices, fictitious sales and non-competitive operations. In 2015 Kraft Foods Group, Inc. and Mondelēz Global LLC were sanctioned for price manipulation in this same market.

Finally, in the metal market, in the case of copper, Arab Global Commodities DMCC is sanctioned for falsification of futures contracts.

This is in addition to the numerous complaints that exist between the CFTC and other corporations for reasons of manipulation in interest rates, currencies, and OTC markets. Even in cases like manipulation in these last markets, a rise in prices in one market translates into an increase in the price of another, so that the manipulation of a market can be an “artificial” rise in the prices of another one.

The following table shows an annual summary of the different complaints filed by the CFCT, classified by year and by market

Table 1.- Sanctions initiated by the CFCT by year and market

	Electricity	Gas	Petroleum	Platinum	Foods	Copper	Foreign exchange and Interest rates
2001	X						X
2002		X					X
2003		X					X
2004		X					X
2005							X
2006		X					X
2007							X
2008		X	X				X
2009							X
2010			X	X			X
2011							X
2012				X	X		X
2013							X
2014							X
2015		X	X		X	X	X

This table shows the different markets (in columns) where the CFCT has intervened in the different years to propose sanctions to different companies for price manipulation. The information has been collected from the CFCT website.

3. EMPIRICAL ANALYSIS

In this section we are going to empirically analyse each one of the two hypotheses proposed in the previous section as causes of the 2002-2008 commodity supercycle: supply and demand vs. financialization. More specifically, we will conduct two main analyses. For the supply and demand hypothesis, we will analyse the correlation between commodity price indices and aggregate production (GDP). In this first analysis, we will use data on commodity price indices (obtained from the World Bank database) and data on OECD GDP and world GDP also obtained from the World Bank database.

For the financialization hypothesis, we will analyze the evolution of the predominant type of transactions in the commodity markets. The definition of the different types of transactions follows the definitions in the paper of Chari and Christiano (2017) who, based on data from Trader Commitment reports provided by the CFCT, define 3 types of transactions: between commercial agents, between non-commercial agents and between a commercial and a non-commercial agent.

3.1. HYPOTHESIS OF THE SUPPLY AND THE DEMAND

To analyse the first hypothesis of supply and demand, we first analyse the correlation between raw materials and aggregate production, in order to give a partial or total explanation to one or the other scenario. We will calculate the correlation matrix of the different series of prices of raw materials and aggregate production, as well as the evolution of these figures annually. In this hypothesis, we assume that increases in aggregate production data will lead to an increase in the prices of raw materials, while decreases in aggregate production will lead to a decrease in prices. Therefore, high correlation data between these two variables could be understood as evidence in favour of the supply and demand hypothesis.

From the data extracted from the World Bank database, we obtain, on the one hand, the data referring to world GDP and the GDP of the OECD countries and, on the other hand, the prices of various indices of raw materials to have an overview for goods similar in nature. The World Bank differentiates 6 types of commodity indices: energy, non-energy, agriculture, metals, minerals, and precious metals. The weights of each of the components within each price index are summarized below:

Energies: Coal (4.7%) Crude oil (84.6%) Natural Gas (10.8%)

Non-energy: Agriculture (64.9%) Metals (31.6%) Fertilizers (3.6%)

Agriculture: Food (Cereals, oils, and all kinds of food) (40%) Beverages (coffee, tea, cocoa) (8.4%) Materials (wood, cotton, tobacco, rubber) (16.5)

Metals; Aluminium (26.7%), Copper (38.4%), Iron (18.9%), Lead (1.8%), Nickel (8.1%), Tin (2.1%), Zinc (4.1%)

Minerals: The same materials excluding iron.

Precious metals: Gold (77.8%), silver (18.9%), platinum (3.3%)

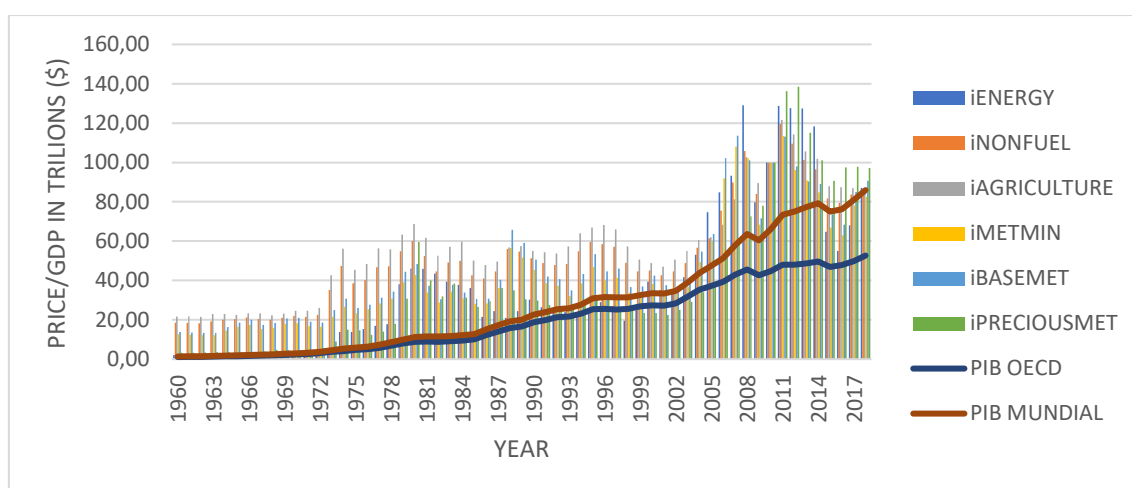


Figure 1. - Commodities Price valuation vs. GDP. This figure shows the price indices of the different commodity indices (in vertical bars expressed in \$) and the evolution of the OECD and world GDP (in lines expressed in trillions of \$) during the period 1960-2018. The data have been obtained from the World Bank database.

Seeing the figure 1, there are relationships between the increases in the prices of raw materials and GDP in broad terms, since the price peaks of the GDP graphs coincide in most cases with the peaks in prices of raw materials, but they do not move in the same proportion. It is true that both series have common movements, but they are not able to give a complete explanation to the great fluctuation of commodity prices. In order to make a more complete analysis of the relationship that exists between commodity prices and GDP, we should do a correlation analysis, although we can already say that not all commodity movements can be explained with movements in GDP, they do not always move simultaneously, nor do they always move in the same proportion. Next we will conduct a correlation analysis to be able to see which relationship exists between the prices of raw materials and GDP, as well as which relationship the prices of raw materials have between them.

With the price indices of the commodity groups, we calculate the annual variation rates of the commodity indices and of the annual GDP from 1960 to 2018. We calculate the variation rates (we do not compare the magnitudes in levels but in differences) to have the percentage of how the indices vary.

$$\text{Variation Rate} = \frac{P_{t_1} - P_{t_0}}{P_{t_0}}$$

From this calculation, we compare the variation in GDP and price indices by categories, calculating the correlations and making the following table of correlations

Table 2. - Correlation of commodities regarding GDP

TOTAL	ENERGY	NON ENERGY	AGRIC	METALS	BASE METALS	PREC. METALS	OECD GDP	WORLD GDP
ENERGY	1,00	0,53	0,49	0,37	0,34	0,56	0,30	0,43
NON ENERGY	0,53	1,00	0,95	0,78	0,77	0,66	0,53	0,65
AGRIC.	0,49	0,95	1,00	0,57	0,55	0,63	0,48	0,60
METALS	0,37	0,78	0,57	1,00	0,99	0,49	0,47	0,57
MINERALS	0,34	0,77	0,55	0,99	1,00	0,48	0,46	0,54
PRECIOUS METALS	0,56	0,66	0,63	0,49	0,48	1,00	0,50	0,59
OECD GDP	0,30	0,53	0,48	0,47	0,46	0,50	1,00	0,96
WORLD GDP	0,43	0,65	0,60	0,57	0,54	0,59	0,96	1,00

This table shows the correlation coefficients between the different commodity indices published by the World Bank and world GDP and OECD GDP. The correlation is calculated on the rates of change of the commodity price indices and the rates of change of GDP. The data has been extracted from the World Bank database.

As can be seen in Table 1, there is a positive relationship between changes in GDP and changes in commodity price indices, so there is some evidence in favour of the supply and demand theory. Most relationships have a correlation coefficient greater than 0.5, so there is also a positive relationship in the growth of commodity prices between categories. Comparing world GDP with the indices of raw materials, the coefficient of non-energy raw materials 0.65, agricultural products (0.60) and precious metals (0.59) are the indices with highest correlations. The lowest correlation with world GDP is 0.43 in energies, although it has a correlation of 0.56 and 0.53 in precious metals

and non-energy materials, therefore either indirectly or directly a growth in GDP largely explains the growth in the price indices of raw materials.

To deepen the analysis on the correlation, we can analyse the dynamic relationship between the variations of the commodity price indices and the aggregate production between 1960 and 2018 using a 5-year rolling window. With this, we can analyse the impact of financialization and speculation in shorter periods, with special emphasis on the commodity supercycle. The evolution of this moving window is represented in figure 2:

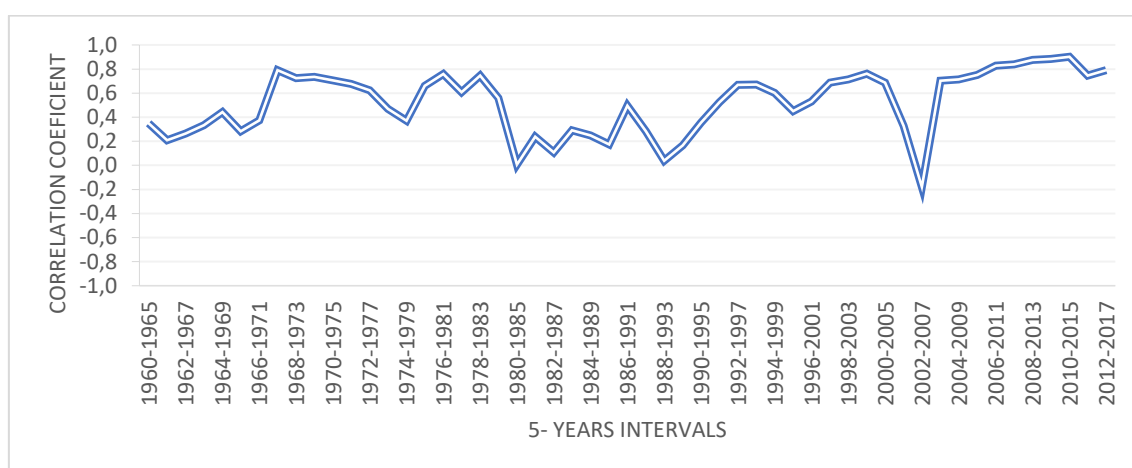


Figure 2. - Correlation coefficient at different lapses of time. This figure shows the evolution of the average correlation of commodity indices with world GDP for 5-year intervals. The data has been obtained from the World Bank database.

The purpose of this graph is to be able to see the variations of this correlation and to be able to analyse if there are periods where price movements can be justified through the correlation coefficient, and if so, in which periods can be better explained.

As we can see in figure 2, the correlations between indices of raw materials and aggregate production vary over time. In the 1980s and early 1990s, the value of these correlations was abnormally low, but from the 1990s on, the correlations between changes in GDP and changes in commodity prices rose to values above 0, 5. However, these correlations decrease to values close to 0 for the 2002-2008 period, coinciding with the super-cycle of commodities. These values imply that in the case of an increase in the price level of raw materials, their demand would not vary or would not be a factor related to the variation in prices. In other cases, the correlation is slightly negative, which means that an increase in GDP would be inversely related to the price level. This evidence goes against the hypothesis of supply and demand precisely during the period

coinciding with the supercycle. This evidence suggests that there may have been something more than genuine demand in the 2002-2008 increase in commodity prices.

The hypothesis of price manipulation during this period of the commodity supercycle is what we will analyse in the next section.

3.2 HYPOTHESIS OF FINANCIALIZATION AND SPECULATION

The objective of this section is to analyse what type of transactions have been conducted in the commodity futures markets during the period coinciding with the commodity supercycle. In this market, transactions are carried out between two agents: a seller and a buyer. Each agent that carries out a transaction in these markets must fill out a series of reports required by the CFCT. It is estimated that between 70% and 90% of the total open interest in commodity markets is recorded in these reports (Chari and Christiano, 2017). When an agent is identified by the CFCT, it is classified as commercial or non-commercial. Commercial agents are those whose economic activity is related to the asset itself, whether it is trade, distribution, transformation or use of it. Instead, non-commercials enter the transaction when their purpose is another non-commercial use. For the latter, it is understood that their participation in the market is for speculative purposes only.

The sum of all operations in the commodity market is called open interest. Open interest is the sum of all long positions registered by outsiders (non-commercial agents) or “S” speculators and all long positions registered by insiders (commercial agents) or “H” hedgers. The sum of all long positions, assuming the transactions have been fully executed, is equal to the sum of all short positions.

$$oi = SL + HL = Ss + Hs$$

In this equation, oi represents open interest, SL is the number of long positions registered by outsiders (non-commercial agents), Ss is the number of short positions registered by outsiders (non-commercial agents), HL is the number of long positions registered by insiders (commercial agents) and HS is the number of short positions registered by insiders (commercial agents).

The data for each of the previous variables can be obtained through the Commitment of Traders reports prepared by the CFCT and available open on its website for download and analysis. The open interest data of the CFCT is broken down into the following items:

- Long and short positions of non-commercial investors “NCL” and “NCS”: this data is extracted from the reports that the agents disclose to the CFCT.

- Long and short positions of non-commercial investors “CL” and “CS”: this data are extracted from the reports that the agents disclose to the CFCT.

- Unreported positions: unreported long and short positions are obtained by the difference between the total open interest and the total positions reported, both short and long.

- The spread is a technical adjustment in the positions of non-commercial agents to show if they have the same number of long and short positions; that is, the higher the spread, the greater the difference between positions.

Given these definitions, we can rewrite open interest as:

$$oi = NCL + CL + NRL + spread = NCS + CS + NRS + spread$$

The problem now is that we have to assign the unreported positions to each one of the two agents: the commercial or the non-commercial. In our case, we are going to use an extreme specification and we are going to assume that all unreported positions refer to commercial agents. With this, we are assuming a scenario where we only consider as a non-commercial agent the one that is duly reported, so the evidence we show is the most conservative case with respect to speculation in the commodity markets. This additional assumption leads us to the following definitions:

$$S L + HL = NCL + spread + CL + NRL$$

$$S s + Hs = NCS + spread + CS + NRS$$

Besides, if we decompose each one of the variables of the formula of total positions or open interest:

$$SL = NCL + Spread;$$

$$HL = CL + NRL;$$

$$SS = NCS + Spread;$$

$$HS = CS + NRS;$$

These last definitions allow us to obtain the number of long positions registered by outsiders SL (non-commercial agents), the number of short positions registered by

outsiders SS (non-commercial agents), the number of long positions registered by insiders HL (commercial agents) and Hs is the number of short positions registered by HS insiders (commercial agents).

Our CFCT data is in percentage out of the total open interest, so the total positions will be 100%. In this way, the results we obtain are in relative terms, which makes the model simpler and more intuitive. With the definitions mentioned above, we are going to establish 3 types of transactions:

- Transactions between commercial agents: in this first group of transactions, both the buying and selling positions are carried out by commercial agents. We approximate the weight of these transactions over the total open interest as the minimum between "HL" and "HS", $\min(HL, HS)$
- Transactions between non-commercial agents: in this first group of transactions, both the buying and selling positions are carried out by commercial agents. We approximate the weight of these transactions over the total open interest as the minimum between "SL" and "SS", $\min(SL, SS)$
- Transactions between a commercial agent and a non-commercial agent. This percentage is the part of the open interest that is not included in the previous two and we calculate it as $1 - \min(HL, HS) - \min(SL, SS)$

We operate this calculation with each one of the 3 types of transactions. The objective of this differentiation is the comparison between one type of investor and another. The type of commercial investor "insider" buys future contracts to carry out its economic activity. Therefore, with greater consumption or use of this material, greater relative weight in the volume of operations, so that transactions between insiders represent interest in the physical raw material. In the case of outsiders, they have a strategy focused on hedging risk and speculation, so an increase in the percentage of outsiders is mainly due to an increase in prices and therefore in profits in these markets. Therefore, the view of financialization can be related to an increase in transactions between non-commercial agents.

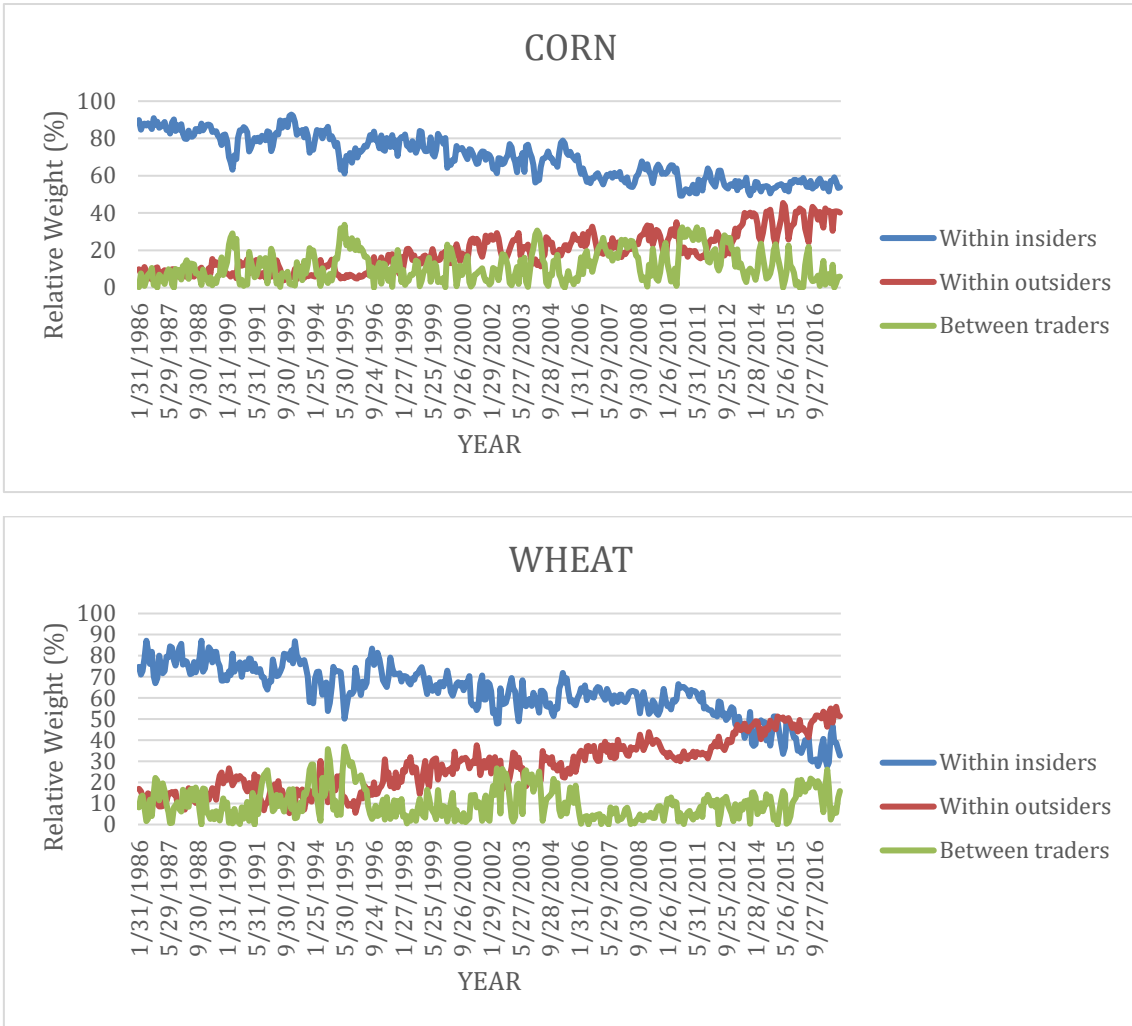


Figure 3.- Relative weights of investor in agricultural markets. This figure shows the temporal evolution of the different transactions that have taken place in the corn and wheat markets during the period from 1986 to 2018. The types of transactions are divided into 3 types: within insiders (when there are commercial agents in the buy and sell position); within outsiders insiders (when there are non-commercial agents in the buying and selling position); between traders (when in the buy and sell position there is a commercial agent and a non-commercial agent). Agents are identified from the equations in section 3.2 using CFCT data.

Figure 3 shows the evolution of the different types of agents in two representative markets for agricultural products: corn and wheat. In the corn and wheat market, the initial situation is a clear predominance of the weights of insiders over outsiders. In the case of corn, the percentage of insiders in total transactions is 90% in the period beginning in 1986 while in the case of wheat, it starts at 70%, but it also reaches 90% as in corn. Later on, we can see how the percentage of transactions between insiders is reduced and the percentage of outsiders increases until it exceeds in the case of wheat the percentage of outsiders over insiders.

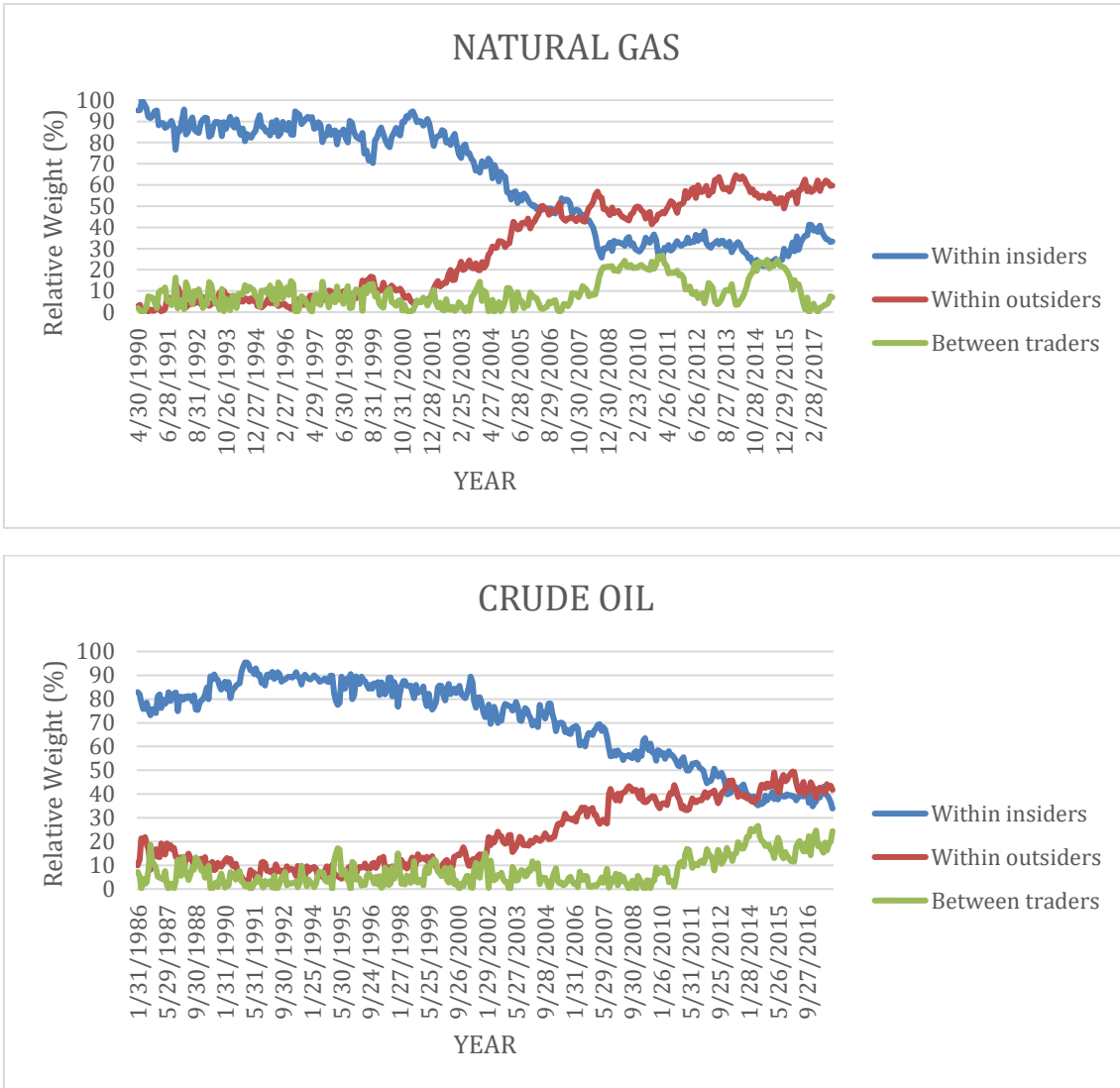


Figure 4.- Relative weights of investor in energy markets. This figure shows the temporal evolution of the different transactions that have taken place in the natural gas and crude oil markets during the period 1986 to 2018. The types of transactions are divided into 3 types: within insiders (when there are commercial agents in the buying position and seller) within outsiders insiders (when there are non-commercial agents in the buying and selling position); between traders (when in the buy and sell position there is a commercial agent and a non-commercial agent). Agents are identified from the equations in section 3.2 using CFCT data.

Figure 4 shows the evolution of the different types of agents in two representative markets of energy markets: natural gas and crude oil. In these cases, we can observe an initial situation where transactions between insiders predominate, especially in the case of natural gas the percentage is very close to 100% of the volume of transactions. Later, we can observe how there is a downward trend since 2000 in the case of the transactions between insiders, and on the other hand, the upward trend among outsiders. In the case of natural gas, the trend of outsiders ends 25% above the percentage of insiders, which can make us suspect on a trend towards speculation.

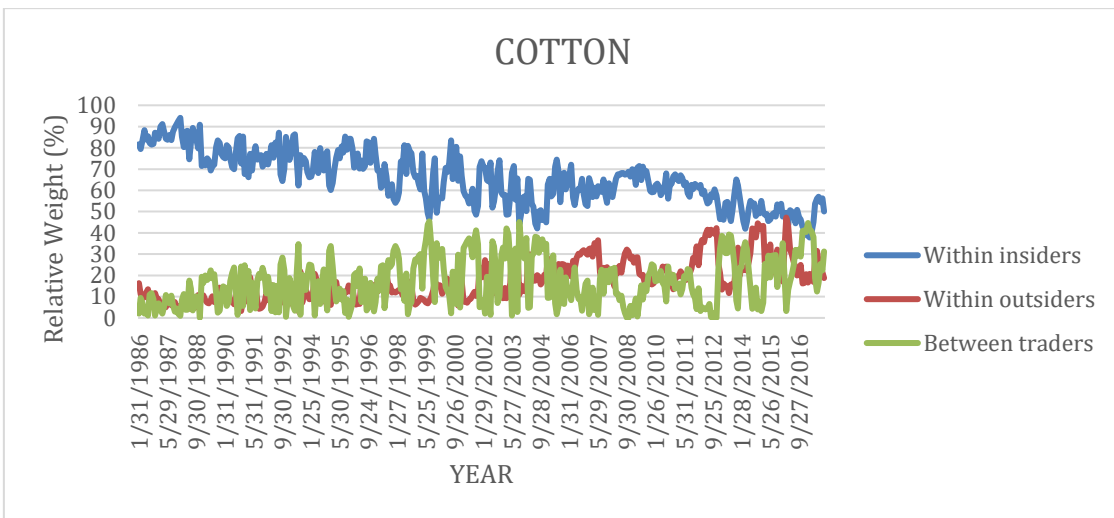
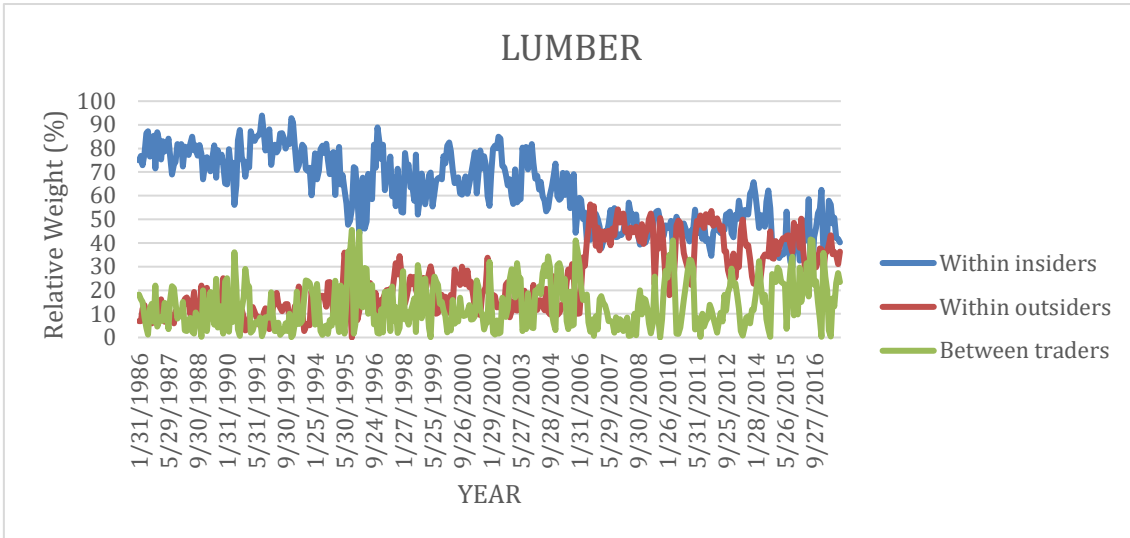


Figure 5.- Relative weights of investor in non-energy material markets. This figure shows the temporal evolution of the different transactions that have taken place in the wood and cotton markets during the period from 1986 to 2018. The types of transactions are divided into 3 types: within insiders (when there are commercial agents in the buy and sell position) within outsiders insiders (when there are non-commercial agents in the buying and selling position); between traders (when in the buy and sell position there is a commercial agent and a non-commercial agent). Agents are identified from the equations in section 3.2 using CFCT data.

Figure 5 shows the evolution of the different types of agents in the case of the non-energy materials that we analyse: the markets for lumber and cotton. We start from a similar situation than the rest of the market previously analysed, where between 80% and 90% of the volume of transactions in the market are purely commercial transactions. Further on, there is a trend since 2000 towards a convergence between the insider and outsider agents, clearly reducing the percentage of operations between insiders, and increasing the percentage of operations among outsiders. In the case of the lumber

market, the percentages of insiders and outsiders have remained at very similar percentages since 2005.

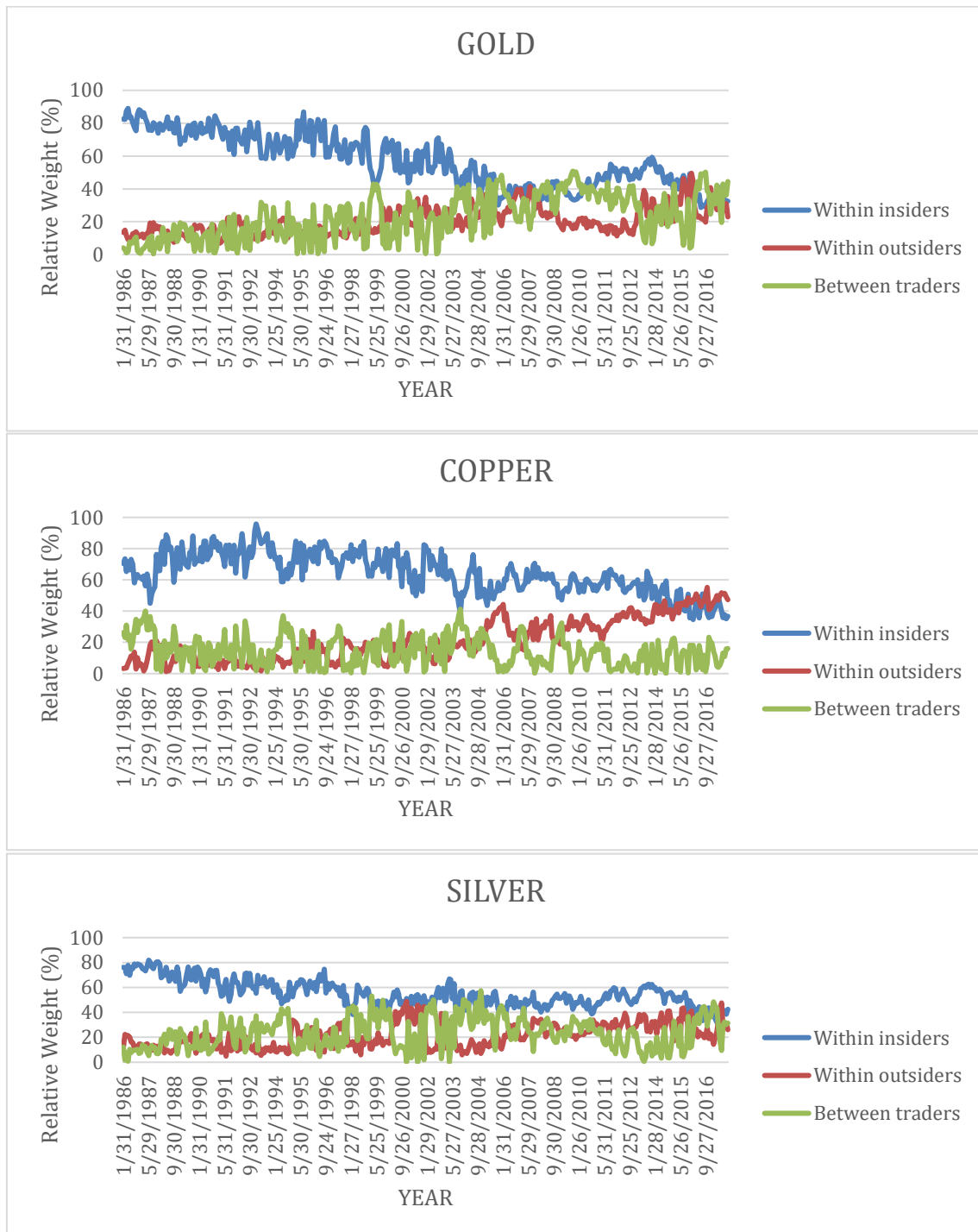


Figure 6.- Relative weights of investor in metal markets. This figure shows the temporal evolution of the different transactions that have taken place in the gold, silver and copper markets during the period 1986 to 2018. The types of transactions are divided into 3 types: within insiders (when there are commercial agents in the buying position and seller); within outsiders insiders (when there are non-commercial agents in the buying and selling position); between traders (when in the buy and sell position there is a commercial agent and a non-commercial agent). Agents are identified from the equations in section 3.2 using CFCT data.

Finally, in figure 6 we show the evolution in 3 metal markets such as gold, silver and copper. In this case of metals, there is a similar trend to the previous markets, starting from a similar situation where the percentage of insiders clearly predominates in 1986. In the case of the gold, silver and copper markets the trend of insiders and outsiders begins with values in the markets of insiders and outsiders very far from each other. However, these percentages reach similar values from 2000 to the end of the analysed trend, highlighting two higher peaks in 2002 and 2015.

Through this empirical analysis, we can conclude that the view of financialization is increasingly visible. There is a trend from the 2000s to the present that leads to an equal relative weight of internal (commercial) and external (non-commercial) investors. This fact makes us think that there is a growing trend towards speculation since the usual trend until the end of the century is predominantly insiders, so investors have no relationship with the asset associated with future contracts. So, the majority of investors focused on the profit in buying and selling of futures contracts is increasingly growing to the detriment of commercial investors. However, the effect of financialization on the commodity supercycle is more ambiguous.

Finally, we show in figure 7, the monthly evolution of the prices of raw materials that we have analysed in this section 3.2.

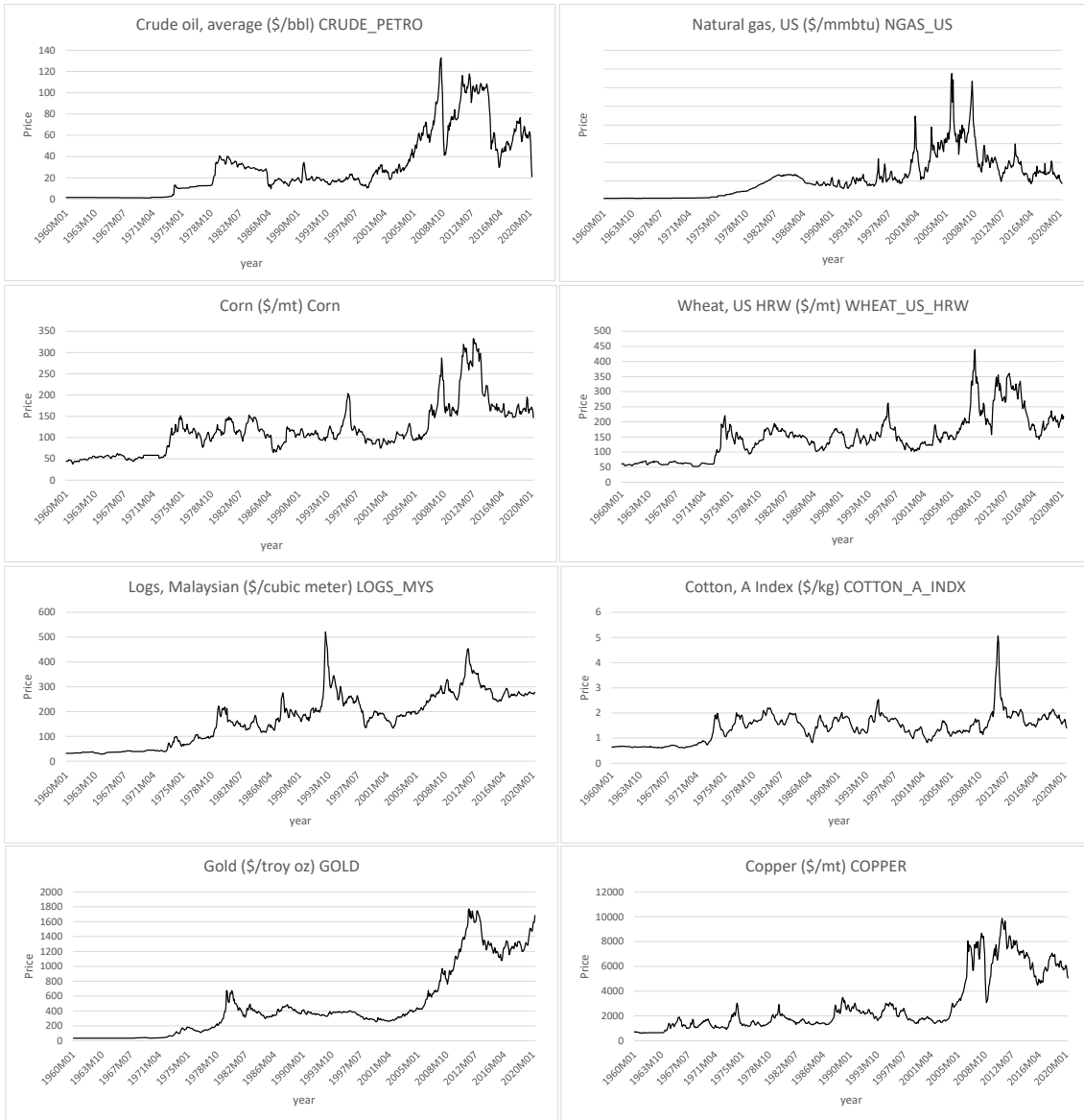


Figure 7.- Monthly evolution of commodity futures markets. This figure shows the evolution of the price of various raw materials from 1960 to 2020. The prices have been obtained from the World Bank database.

In these graphs we can see the evolution of prices in each one of the analysed markets. In these graphs, we can see a great growth in a fairly common period of time in each of the markets. Observing the evolution of prices in figure 7 we can see how there are mainly 4 periods whatever the raw material analysed: a first period of price stability that starts from 1960 to 1971 approximately; later a period of growth and some instability; at the end of the 90s there is a period of relative stability with low price levels; finally, from 2000 the price level increases greatly in two large peaks in 2007 and 2012, doubling, tripling or even multiplying by 5 the prices in less than 2 years. This last period coincides with the increase in transactions between outsiders, which shows that the interest in operations grows as the price of raw materials grows.

If financialization was the main cause of the 2002-2008 supercycle, given that the weight of non-commercial agents has continued to increase progressively to date, the prices of raw materials should have followed an upward trend. However, after 2014 there is a sharp drop in the prices of raw materials while the percentage of non-commercial agents continues to rise.

4. CONCLUSIONS

Through the empirical analysis, as well as the data obtained through the different sources of information, we can conclude that there has been some manipulation in the prices of the commodity markets. On the one hand, in view of the predominant financialization in the early 2000s onwards, the markets have a tendency towards wealth creation concerning any type of financial market to the detriment of conventional markets. This has generated during the end of the 20th century a trend for the manipulation of the markets and speculation towards a way of investing fundamentally focused on short-term profits. These markets tend to have differences in information and are prone to price manipulation as shown in the numerous sanctions issued by the CFTC to a large number of companies and markets.

On the other hand, the growth factor and production do not seem to completely explain the growth of prices, since if it is true that historically there is a production-price relationship, the trend during the supercycle for this relationship is completely broken, leaving aside the supply and demand hypothesis.

From the different data obtained based on research and empirical analysis, we propose the following measures in order to find a new balance between supply and demand.

- Investigate large transactions in commodity markets in search of manipulation, focus on non-commercial investors with big shares in the markets.

- Increase penalties to avoid repetition in falsehood, price manipulation, etc.

- Set a lower annual maximum percentage of outsiders year after year, with the intention of reducing the relative weight of investors focused on price speculation and increasing the relative weight of insiders over them.

- Regarding the latter, there is a control proposal so that there is no abuse of power in the market. The CFTC has already issued a press release about this measure that appears to have been well received by the market, and that on other occasions it has been in forced. Although this measure seeks to avoid monopolies or abuse of power by a sole investor, it can help reduce the number of outsiders. (CFTC: 2013)

- Analyse the variations in prices in order to explain those variations and the search for anomalies in the behaviour of market prices.

The lessons of this latest commodity supercycle can serve to improve efficiency in these important markets. Let us hope that in the next supercycle (that might be taking place at the moment), many of the inefficiencies detected will not be repeated.

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