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A Second Look at the 2007-08 Food Price Crisis: Considering the Impact of Endogenous Dynamics on Food Prices

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ABSTRACT

This paper offers an alternative to the conventional explanation of the 2007-08 food price crisis in terms of escalating demand or dwindling supply. Instead, its focus is on the legal-institutional structure of commodity futures markets, which has witnessed a drastic alteration in the role of speculators. These have transformed from “market makers” (that keep commodity futures markets liquid by arbitraging on price fluctuations) to “market breakers”. Index speculation, in particular, has had the effect of muddling information about market “fundamentals” because of the need – brought about by commodity index swaps – for swap dealers to hedge the fluctuations of an index of commodity prices by opening and periodically rolling over long-only positions. This periodical rollover to comply with contractual obligations, rather than in response to anticipated fluctuations in the availability of a commodity in the future, can induce a “contango bias” in the commodity futures market that, in turn, might have given the wrong signals to market operators, leading to a condition of induced (rather than pre-existing) scarcity and to an increase in spot prices in the 2007-08 crisis.

INTRODUCTION

Starting at the end of 2007, commodity markets witnessed an increase in the prices of major food commodities. These included both staple grains like rice, wheat and maize (Ghosh 2010b), but also cash crops like coffee (Kerckhoffs, van Os, and Vander Stichele 2010, 7). They peaked during 2008, generating waves of hunger in countries where a sizeable fraction of people’s incomes is spent on food (Holt-Gimenez and Patel 2009, 6), and subsequently petered out towards the end of that year. A similar rise in food prices has occurred from the end of 2011 (Ziegler 2011, 299 ff.), reaching worrying levels once again around the time of writing (Chandrasekhar and Ghosh 2012).

The debate following the 2008 food price crisis has sparked wildly diverging opinions. On the one hand, a series of factors relating to the “economic fundamentals” of food production have been pointed at as possible culprits. Such factors include bad harvests and/or decreasing yields (e.g. due to soil depletion caused by increased fertilizer use), increasing competition between food crops and biofuel plantations, oil prices and

increased demand for livestock fodder (consisting of grains) as a consequence of increased meat consumption in countries like India and China (Clapp 2012, 130; Ghosh 2010a, 72–73). While the role of market fundamentals cannot be ruled out as such, the exclusive focus on “external” forces in producing the food price shock can be criticized for turning a blind eye on the endogenous dynamics of financial contraction and expansion (De Schutter 2010, 3). This brief paper aims to shed light precisely on these dynamics, which have engendered, for example, a demand for heightened regulation of derivative commodity trading.

In order to do so, the paper proceeds as follows. In Section I it looks at the origins of commodity futures markets, and at the role of arbitrageurs within such markets. Section II then introduces another type of speculation, seeking to hedge the fluctuations of a commodity index by taking long-only positions on commodity futures markets. Section III looks at a landmark wave of deregulation of derivative commodity trading which altered the composition and relative weight of different type of speculators after the year 2000. Finally, Section IV offers an alternative explanation for the 2007-08 food price hike, by looking at the role played precisely by index speculators in an unregulated OTC market after 2000, focusing, in particular, on the “contango bias” that the systematic rollover of long-only positions might have induced in commodity futures markets.

I. HEDGERS AND ARBITRAGEURS

Commodity markets are simply spaces where deliverable goods are traded; as such, commodities are a category extending beyond agricultural products, including also oil and gas (Kerckhoffs, van Os, and Vander Stichele 2010, 2). Although physical delivery forms part of the definition of a commodity, this does not mean that the only allowed commodity trades are those for immediate delivery (also known as “spot” trading). In fact, it is precisely out of the need to shelter one’s supplies or sales from the fluctuations of “spot” prices that derivative instruments made their appearance in the world of commodities. So, for example, a company producing bread might be willing to purchase today, at a set price, a certain amount of grain for future delivery. The contract by which this result would be obtained is called a *forward*. The benefit of this operation would be that the company could “lock in” the cost of its anticipated demand for a raw material it knows it will need in the future (Robbins 2003, 167–168). Similarly, a grain producer might want to undertake an obligation to deliver a certain amount of his/her production at a future date for a set price, so as to stabilize his/her income flow and have some figures on which to base a calculus

of future production. Initially, such contracts would be made on an *ad hoc* basis, meaning that their precise content would be determined according to the needs of the parties. As the volume of traded commodities rose during the second half of the nineteenth century (Peck 1985, 4–7), however, the need to allow bulk trading on exchanges featuring many different participants brought with it a tendency towards the standardization of derivative contracts, which pre-specified the type of commodity as well as the delivery date (Kaufman 2010, 30). These standardized contracts allowing to buy and sell commodities for future delivery are called *futures* (De Schutter 2010, 9).

In traditional markets for commodity futures, two main types of actors would typically be seen at work: hedgers and arbitrageurs. Hedgers would be those operators trading in derivatives to protect themselves against future price fluctuations for business needs. This is where the bread-making company and the grain manufacturer of the earlier example would fit. Next to them, one would find arbitrageurs (or “traditional” speculators). These would not be interested in the physical delivery of the commodity at a future date. Therefore, they would act on the market by undertaking commitments that would cancel each other out (Kaufman 2010, 30). So, for example, one could commit to future purchase of grain at, say, \$100, and then make a profit by exploiting subsequent price fluctuations that allowed to undertake a future sale at, say, \$105; this buy-and-sell strategy that profits from increased prices is called *going long* (Garner 2010, 25). Alternatively, a traditional speculator might sell before buying. This is possible because futures contracts simply entail an obligation to buy and sell at a future date, and do not require ownership of the physical asset (so long as one does not hold them until delivery comes due) (Garner 2010, 26). Hence, an arbitrageur can promise to sell grain at a future date (at a time when he/she expects the trading price to be higher than it would be, were he/she to undertake the same commitment at a later time, when the delivery date is closer) and then promise to buy it closer to delivery date when trading price has gone down. In the end, the two obligations cancel out and all the arbitrageur is left with is the profit from selling high and buying low—a strategy called *going short* (Garner 2010, 25). In order for one to be successful in this type of arbitrage, possessing information on the underlying supply dynamics of the commodity would be key (Masters and White 2008, 2). Furthermore, the presence of arbitrageurs on the commodity futures market would create an ongoing stream of participants willing to buy and sell futures, thereby guaranteeing the possibility for hedgers to find a counterparty with ease (Kaufman 2010, 30).

II. INDEX SPECULATORS

The progressive deregulation of derivative commodity markets gradually enlarged the camp of participants uninterested in taking delivery of physical commodities, well beyond traditional arbitrageurs. Whereas the number and size of speculators was originally constrained by regulatory limits on the amount of contracts they could hold, the situation changed during the 1990s. At that time, in fact, some actors obtained significant exemptions from the U.S. Commodity Futures Trading Commission (the regulatory body entrusted with supervision of commodity futures exchanges), allowing them to increase their position on the market (Bjerga 2011; Kaufman 2010, 31). Among such actors were merchant banks like Goldman Sachs, which enacted a revolutionary scheme that would prove to be one of the main contributing factors to the food price shock of the late 2000s.

In the early 1990s, in fact, Goldman Sachs came up with the idea of creating a commodity index fund. A commodity index is simply a mathematical formula in which the prices of different commodities are factored in according to different weights (Kerckhoffs, van Os, and Vander Stichele 2010, 5). As a consequence, the value of the index can be thought of as the price of a basket of commodities, held in different proportions. Furthermore, under the assumption that the prices of futures reflect—at maturity—prices experienced on the spot market, indexes typically take as reference the price of the nearest-expiring futures contract (Masters and White 2008, 8). Assuming futures prices later transfer over to the spot market, then the index can still be said to track commodity prices movements over time (Frenk and Turbeville 2011, 8).

This remark leads to the basic idea behind a commodity index fund, which is to replicate ownership of a basket of commodities so that “an investor theoretically experiences the same [financial] consequences as one who would have owned the corresponding commodities over the period of investment, and then selling them at the end of the period” (Frenk and Turbeville 2011, 9). The way this is done is through a “swap” contract. A swap is simply a contract whereby two parties agree to exchange cash flows (De Schutter 2010, 9). In a commodity index swap, an institutional investor like a pension fund agrees to pay the swap dealer (who is typically a merchant bank) the three-month Treasury bill rate, plus a management fee. In return, they will be credited with the changes in the value of the index over the agreed period of investment (Masters and White 2008, 9). Hence, the investment tracks variations in the price of a basket of different commodities, essentially mimicking ownership of those commodities. Since the bank is committed to delivering returns replicating “synthetic” ownership of a bundle of commodities, it is necessary for it to

balance this liability through an investment strategy that will match the index's performance. Now, since the index is obtained by combining a basket of commodity futures prices, the "natural" hedging strategy for the bank is simply to hold futures in proportion to the index's composition: any increments in the value of the index will be matched by increases in the value of the futures the bank holds in its portfolio. Directly holding positions that follow the index puts the bank in the condition to transfer any increases in the value of the index over the stipulated period to the institutional investor, in exchange for the three-month Treasury bill rate plus a management fee.

A significant issue arises here. In fact, while the index is an ongoing investment, futures—by their very nature—expire at a certain date into the future (Frenk and Turbeville 2011, 8). As a consequence, the bank will have to periodically "lengthen" its futures exposure to contracts with a later maturity date. The way it does this is by evening out the commitment to buy with a commitment to sell, thereby offsetting its exposure to futures nearing maturity. Furthermore, it will also open—on the "buy" side—new positions with a later maturity date (Garner 2010, 28). The need periodically to "roll over" expiring commitments into others with later maturity dates arises purely from the bank's contractual commitment to deliver returns on the index. Hence, it will carry out such task regardless of the underlying market conditions (Frenk and Masters 2010, 50). This, as shown later in this paper, has significant consequences.

III. SPECULATION AFTER THE YEAR 2000

Despite Goldman Sachs making index speculation available already in the early 1990s, it was only after year 2000 that this type of speculation gained momentum, to the point that—in 2008—about 40% of all open positions in the commodity futures market had come to be held by index speculators (Masters and White 2008, 34). The reason of this tidal change in the weight of index speculation is to be found in a landmark regulatory development occurred in the U.S. Indeed, 2000 is the year in which the Commodity Futures Modernization Act was passed. To understand the import of the Act, it is first of all necessary to introduce the idea of over-the-counter (OTC) derivative. This is simply a derivative contract that is not standardized and cannot, therefore, be traded on an open exchange, but is instead stipulated by interested parties in an *ad hoc* fashion (Kerckhoffs, van Os, and Vander Stichele 2010, 4). The Commodity Futures Modernization Act allowed over-the-counter derivatives to trade in commodities, outside of the supervision of the U.S. Commodity Futures Trade Commission (CFTC). In essence, this meant that OTC

derivatives could be entered into freely, without any need to disclose information to a regulatory body (Ghosh 2010a, 78). Furthermore, it became equally possible for parties uninterested in hedging for commercial purposes and only interested in speculation to enter into OTC commodity transactions (De Schutter 2010, 5). These changes opened the floodgates of commodity markets to institutional investors with large amounts of money to park. And their influence came to be felt precisely through the mainstreaming of OTC instruments like index swaps that, by enabling the business of commodity index funds, changed the face of speculation on commodity markets. Index speculation later took more refined forms, such as that of commodity exchange traded funds (ETFs). Unlike commodity index swaps, which are OTC derivatives negotiated bilaterally between a bank and an institutional investor, commodity ETFs issue shares that are traded on the stock exchange and make commodity investment accessible also to a retail clientele. From the point of view of their effect on the commodity market—which is discussed in the next section—they can however be considered equivalent to funds established through commodity index swaps (Frenk and Turbeville 2011, 9).

The liberalization of commodity speculation after the year 2000 also increased the range of speculators that would take both short and long positions in an attempt to arbitrage on price volatility, in much the same way as a “traditional” speculator would (Lines 2010, 14–15). However, unlike a traditional speculator, these “money managers”—typically featuring hedge funds (United Nations Commission on Trade and Development Secretariat 2011, 19)—would trade with little regard to the underlying economic fundamentals, and resort instead to econometric forecasting based on past values of a given commodity—to identify and exploit price trends in commodity markets, as well as in other asset markets (Staritz 2012, 13; Talbot 2002, 231–232). Because money managers actively manage a diversified portfolio, in which commodities feature alongside other assets, some of the positions they adopt on commodity markets are a consequence of events occurring in other exchanges: which explains recent findings that commodity prices have come to be increasingly correlated with each other, as well as with those of other types of asset (Windawi 2012, 16 & 20).

The increased presence of speculators of the latter kind—who attempt to profit from market volatility—has also been described as a further side-effect of index speculation. Index speculation—as I explain further in the following section—induces price dynamics that are unrelated to market fundamentals. Consequently, futures markets are less able to function on information about economic fundamentals and this uncertainty translates into

increased volatility that, in turn, attracts participants like money managers, who are interested precisely in exploiting “price swings rather than fundamentals” (Frenk and Turbeville 2011, 30).

IV. COMMODITY INDEX SPECULATION AND ESCALATING COMMODITY PRICES

In the commodity futures market, the relation between the “spot” price (for immediate delivery) and the futures price is typically that the former will be greater than the latter (Kaufman 2010, 30). More generally, sales further into the future will be carried out for less than if they were carried out closer to the present. As a consequence, if one plotted the price for a particular commodity, say wheat, starting from the “spot” price, then moving onto the price of the nearest expiring future, then to the second-nearest expiring future, and so on, one would theoretically see such figures arranged along a downward-sloping curve, meaning that prices get lower as the maturity date is pushed further into the future. This condition is typically referred to as *backwardation*, and it reflects the basic nature of a futures contract as a form of insurance against future price fluctuations. In order to protect oneself from such fluctuations, a premium is paid in terms of a lower price than one would receive by trading on the spot market.

There is, however, a second possibility. It can, in fact, happen that the price for future sale of a commodity exceeds that of a spot transaction. This situation is called *contango*. While, in theory, this should be an anomaly on commodities markets, it has actually been the norm during the 2008 world food price crises. As futures prices exceed spot prices, this may lead to a hoarding of supplies (to take advantage of future increases in price) and to a surge in demand (to take advantage of the lower current price), thereby exacerbating scarcity in the affected commodities and driving up also their spot price (Frenk and Turbeville 2011, 6). In other words, in a *contango* market, futures prices may drive up commodity prices in a kind of self-reinforcing loop (De Schutter 2010, 4).

In relation to this phenomenon, Frenk and Turbeville (Frenk and Turbeville 2011) eloquently argue how commodity index speculation plays a decisive role in “nudging” commodity markets towards contango. At the same time, it sends all the wrong signals to actual suppliers and consumers of the commodity, with the chance of creating a situation of induced scarcity that—in the 2008 crisis—led to such hardship as to prompt the peoples of several countries to take to the streets. The way this comes about is precisely because of the need, for the banks that are party to a commodity swap deal, periodically to roll over expiring futures contracts into longer-dated ones.

When markets are in contango, this means that—on “roll time”—banks will offset their position in the near-dated future at a lower price than the cost of taking a position in a contract expiring later. In other words, they will lose money. However, the cost of this is not actually felt by the bank, but it is charged back to the original investor as a “management fee” (Frenk and Turbeville 2011, 10). The cost of rolling over in a contango market detracts significantly from the returns investors may otherwise obtain from a commodity’s increasing price, as captured by the commodity index (Blas 2009). Despite this, increasing commodity prices have been a powerful lure for investors seeking an easy way to diversify their portfolio, especially following the dotcom and the housing price bubbles (Staritz 2012, 11; Ghosh 2010a, 28). Furthermore, the passive nature of commodity index investment forgoes the need to appoint and monitor a dedicated trader, with the swap dealer-bank taking care of the periodic roll (Greer 2000, 46; Masters and White 2008, 9).

Because index speculators routinely roll over their contracts at set times during each month, as well as because of the sheer turnover involved in this operation, it occurs that: (1) the nearest-expiring future becomes relatively underpriced during the roll period due to a surge in supply from index investors to offset their outstanding positions, whereas (2) the later-expiring future becomes relatively overpriced, again because of a surge in demand from index speculators. *The simultaneous price depression of near-dated futures and inflation of far-dated ones is precisely what nudges commodity futures markets towards contango.* This dynamic is further exacerbated by the trades that other speculators undertake in anticipation of the “Goldman roll.” This involves taking sell positions on the near-dated future before the roll period (at a higher price than would be available during such period) and buy positions on the far-dated future (at a lower price than during the roll period). When these positions are closed during the roll period, speculators manage to buy short-term for less and sell long-term for more than they originally spent during the pre-roll phase, thereby making a profit (Mou 2011, 6). The fact that a number of speculators all engage in the same activity in anticipation of the roll, however, also acts as a mechanism that further depresses near-dated futures and inflates later-dated ones (Frenk and Turbeville 2011, 13), thereby nudging the market towards contango and rising commodity prices even more, so as to make this kind of speculation a positive feedback force (Bradford De Long et al. 1990, 394) that compounds the contango bias already induced by index rolls. Finally, as commodity prices keep rising, more financial operators are attracted to commodity markets. As new money pours in, the size of long-only positions by index

speculators increases, so that the market's bias towards contango and rising prices is further amplified (Frenk and Turbeville 2011, 17; De Schutter 2010, 4).

The contango bias of commodity markets as a result of index speculation ultimately makes the possibility of de-coupling investment in commodities from externalities in the real world just a fiction. Some scholars have argued that it is logically impossible for investment in derivative instruments to cause a rise in commodity prices, starting from the assumption that these may only rise if physical commodities are actually hoarded and scarcity is artificially increased on the market (Irwin, Sanders, and Merrin 2009, 379–380). However, the effect of commodity index speculation is to make the price rise *precede* the hoarding of commodities by participants with access to physical storage facilities (rather than the hoarding preceding the price hike), who will hoard supplies precisely in response to the distorted price signal (rather than the other way around) (Frenk and Turbeville 2011, 9).

This is further exacerbated by uncertainty about the part played by index speculators at any given time, as only the latter have details on the specific size of the futures positions they will roll (Frenk and Turbeville 2011, 11). It is therefore difficult to know whether a price change is the result of speculation or of changes in the economic fundamentals. When price information becomes muddled, it is therefore possible that it affect the behavior of economic operators, even when movements are purely speculative (Frenk and Turbeville 2011, 29; Frenk and Masters 2010, 30). It does not help that part of the toolkit of market operators and observers includes neoclassical models that systematically impute changes in price to economic fundamentals, thereby exacerbating the tendency of operators to act based on prices, as if the latter always conveyed information about the relative scarcity of a particular commodity (Frenk and Turbeville 2011, 29; Frenk and Masters 2010, 44).

CONCLUSION

In this paper, I have attempted to offer an alternative to the conventional explanation of the 2007-08 food price crisis in terms of escalating demand or dwindling supply. Instead, my focus has been on the legal-institutional structure of commodity futures markets, which has witnessed a drastic alteration in the role of speculators. These have transformed from “market makers” (that keep commodity futures markets liquid by arbitraging on price fluctuations) to “market breakers”. Index speculation, in particular, has had the effect of muddling information about the anticipated scarcity of a given commodity because of the need – brought about by commodity index swaps – to hedge the fluctuations of an index

of commodity prices by opening and periodically rolling over long-only positions. This periodical rollover to comply with contractual obligations, rather than in response to anticipated fluctuations in the availability of a commodity in the future, can induce a “contango bias” in the commodity futures market that, in turn, might have given the wrong signals to market operators with access to storage facilities, leading to a situation of induced scarcity and increased spot prices in the 2007-08 crisis.

If this interpretation is correct, then it could be argued that the dynamics affecting the markets for agricultural commodities since the year 2000 display a high degree of the self-referentiality, in the sense that price movements feed into each other with little weight given to information about economic fundamentals. When these dynamics are translated into the world of “real” economic variables, however, the effects are often deeply destabilizing, as lucidly exemplified by the 2008 world food price crisis. More generally, the volatility of markets for agricultural commodities has been sending—on a day-to-day basis—systematically wrong signals to producers, causing over-sowing or under-cultivation (Ghosh 2010a, 79). Finally, whereas higher commodity prices have trickled down to consumer markets, the hike of 2008 has not been followed by a symmetrical decrease (as it occurred on international commodity markets). Higher prices have “stuck,” especially in countries without adequate structures in place to guarantee domestic food sufficiency and whose currencies have suffered depreciation vis-à-vis the dollar, thereby making it possible for prices of dollar-denominated imports to stay high even after the decline in global food prices after 2008 (Ghosh 2010a, 81).

BIBLIOGRAPHY

- Bjerga, A., 2011. How Goldman Sachs Started the Food Speculation Frenzy. *The Ecologist*. Available at: http://bit.ly/bjerga_gs.
- Blas, J., 2009. Commodity Indices: 'Rollover' Practice Hits Investors. *Financial Times*. Available at: http://bit.ly/blas_roll.
- Bradford De Long, J. et al., 1990. Positive Feedback Investment Strategies and Destabilizing Rational Speculation. *The Journal of Finance*, 45(2), pp.379–395.
- Chandrasekhar, C.P. & Ghosh, J., 2012. Another Looming Food Crisis. *The Hindu Business Line*. Available at: http://bit.ly/ghosh_chandr.
- Clapp, J., 2012. *Food*, Cambridge: Polity.
- Frenk, D. & Masters, M.W., 2010. *Anthropic Finance: How Markets Function*, Washington D.C.: Better Markets. Available at: http://bit.ly/frenk_masters.
- Frenk, D. & Turbeville, W., 2011. *Commodity Index Traders and the Boom/Bust Cycle in Commodities Prices*, Washington D.C.: Better Markets. Available at: http://bit.ly/fr_turbeville.
- Garner, C., 2010. *A Trader's First Book on Commodities*, Upper Saddle River, NJ: FT Press.
- Ghosh, J., 2010a. *Commodity Speculation and the Food Crisis*, World Development Movement. Available at: http://bit.ly/ghosh_wdm.
- Ghosh, J., 2010b. The Unnatural Coupling: Food and Global Finance. *Journal of Agrarian Change*, 10(1), pp.72–86.
- Greer, R.J., 2000. The Nature of Commodity Index Returns. *The Journal of Alternative Investments*, 3(1), pp.45–53.
- Holt-Gimenez, E. & Patel, R., 2009. *Food Rebellions: Crisis and the Hunger for Justice*, Oxford: Pambazuka Press.
- Irwin, S.H., Sanders, D.R. & Merrin, R.P., 2009. Devil or Angel? The Role of Speculation in the Recent Commodity Price Boom (and Bust). *Journal of Agricultural and Applied Economics*, 41(2), pp.377–391.
- Kaufman, F., 2010. The Food Bubble: How Wall Street Starved Millions and Got Away With It. *Harper's Magazine*, July 2010, pp.27–34.
- Kerckhoffs, T., van Os, R. & Vander Stichele, M., 2010. *Financing Food: Financialisation and Financial Actors in Agriculture Commodity Markets*, Amsterdam: Centre for Research on Multinational Corporations. Available at: <http://bit.ly/kerckhoffs>.
- Lines, T., 2010. *Speculation in Food Commodity Markets*, World Development Movement. Available at: http://bit.ly/lines_commodity.

- Masters, M.W. & White, A.K., 2008. *How Institutional Investors Are Driving Up Food And Energy Prices*, The Accidental Hunt Brothers. Available at: http://bit.ly/masters_white.
- Mou, Y., 2011. *Limits to Arbitrage and Commodity Index Investment*. PhD Dissertation. New York: Columbia University. Available at: http://bit.ly/mou_2011.
- Peck, A.E., 1985. The Economic Role of Traditional Commodity Futures Markets. In A. E. Peck, ed. *Futures Markets: Their Economic Role*. Washington D.C.: American Enterprise Institute for Public Policy Research, pp. 1–81.
- Robbins, P., 2003. *Stolen Fruit: The Tropical Commodities Disaster*, London: Zed Books.
- De Schutter, O., 2010. *Food Commodities Speculation and Food Price Crises*, UN Special Rapporteur on the Right to Food.
- Staritz, C., 2012. *Financial Markets and the Commodity Price Boom: Causes and Implications for Developing Countries*, Vienna: Oesterreichische Forschungsstiftung fuer Internationale Entwicklung. Available at: <http://bit.ly/staritz>.
- Talbot, J.M., 2002. Information, Finance and the New International Inequality: The Case of Coffee. *Journal of World-Systems Research*, 8(2), pp.214–250.
- United Nations Commission on Trade and Development Secretariat, 2011. *Price Formation in Financialized Commodity Markets: The Role of Information*, New York-Geneva: United Nations.
- Windawi, A.J., 2012. *Speculation, Embedding and Food Prices: A Cointegration Analysis*, New York: Columbia University. Available at: <http://bit.ly/windawi>.
- Ziegler, J., 2011. *Destruction Massive: Géopolitique de la Faim*, Paris: Seuil.