

Chapter 20

Operating Commodities Market by Automated Traders

Fodil Laib

CEVITAL Group, Algeria

Mohammed Said Radjef

Unit Research LaMOS, Algeria

ABSTRACT

This is an introductory work to the field of automatizing futures markets, related to commodities, so far operated by human traders. First, we build a mathematical framework for a futures market with many producers and consumers represented by automated traders in the market platform. Then we suggest an automatic trading strategy for the automatons. This strategy takes into account the forecasts of supply and demand streams as well as the evolution of nominal price. Later, we recall a set of analytical criteria used to measure the performance of a trading strategy. Next, we illustrate our approach by showing a price pattern generated by the automatic strategy and calculate its performances. Finally, we exhibit a heuristic based on simulation allowing to compute a quasi-optimal parameters matrix for this automatic trading system.

INTRODUCTION

Since their inception in mid-1850 in the US, initially intended for corn and wheat trading, futures markets had expanded and diversified in the community of merchants, producers, farmers, consumers, speculators, thanks to the flexibility brought in hedging prices of crops, metals, crude oil, etc (CBOT, 1998 ; Hull, 2002). The basic instrument traded in this market is a *futures contract* which is a binding agreement between a seller and a buyer, it is related to a specific commodity (the underlying), with specific delivery time and location. The main feature of a futures transaction is that the price of the commodity is fixed at the present time, whereas the effective delivery of the merchandize, from the seller to the buyer, will occur in a future date, which could be several months or years ahead (Teweles & Jones, 1999).

Automation in futures markets had partially started in the last two decades by replacing pit brokers by central computers receiving orders from outside human traders. The computer saves the orders, sort

DOI: 10.4018/978-1-5225-0997-4.ch020

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them depending on their types and price values, performs transactions and updates traders' positions (Barclay et al., 2003; Weber, 2006). A detailed mathematical description of the futures market's platform was provided in (Laib & Radjef, 2011a), the market mechanism was explained as well as the evolution of traders' positions. Nowadays, another step in the automation process is necessary. We suggest herein to replace the human traders, so far operating futures market, by automated traders sufficiently intelligent to react to the supply and demand (S&D) forecasts and make price projections, then issue sale and buy orders which are channeled to market platform where they are executed. We consider a market where two groups of automated traders are involved. The first group is representing the interests of producers looking to hedge their selling price and the second group of automatons are working on behalf of consumers looking to hedge their buying price. This new practice may bring more rationality to the futures market and avoid major financial crashes and speculative bubbles due to irrational behavior of human traders (Ohara, 1998; Roll, 1988).

Several studies in the literature suggested approaches based on technical analysis (Murphy, 1999) to automate the process of trading in futures markets. These approaches assesses the price history and other indicators, like exchanged daily volumes and open interest, in order to establish the relevant order to put in the market platform. Shelton (Shelton, 1997) suggested an original approach of trading futures formulated as a theoretical 2-person game against nature between a trader and the market; the market was assumed to have different moods (risky, less risky, etc.), and the trader has several strategies (takes an aggressive position, less aggressive, exiting the market). The price formation process and its link with investors' behavior has inspired many authors like Levy (Levy, 2008) who applied the principle of phase transition known in statistical mechanics to interpret price patterns. Preist (Preist, 1999) has suggested an agent-based technic for trading commodities via the Internet; a set of agents, representing the participants, enter into negotiation in a series of double auctions in order to determine the market price. A genetic approach developed in (Arthur et al., 1996) helped to clarify the link between fundamental trading and technical trading and showed how bubbles occur.

The next section outlines the mathematical formulation of the futures market's mechanism designed for many producers and consumers, it shows how transactions occur and how traders' positions are updated. The third section introduces the automatic trading strategy used by automatons to issue their selling and buying orders. This strategy takes into account the stream of S&D forecasts as well as the evolution of nominal price. The strategy was parameterized in order to facilitate its tuning later in conjunction with the stochastic profiles of the producers and consumers' S&D forecasts profiles. A set of seven analytical criteria measuring the performance of a trading strategy are provided in the fourth section. When aggregated, these criteria provide the average performance of the strategy measured on one set of S&D forecasts time-series; over a sample of time-series, we compute the global performance. The fifth section illustrates our study by the mean of two computational examples, in both cases we consider a market with 3 producers and 4 consumers having specific S&D forecasts profiles. In the first example, we assume a fixed trading parameters matrix, then a Matlab code plots the price pattern resulting from our automatic trading strategy and displays the obtained average and global performances. The second example is a simulation-based heuristic allowing to compute the quasi-optimal parameters matrix for our trading strategy.

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