

U-Mart Textbook for Education

1 What Is Futures Market??

1.1 How Does Future Market Works?

Futures trade is a trade to promise the delivery of a commodity (or a bond) at a certain point of time in the future at the contracted price. When you resell or buyback the commodity, you are allowed to make settlements by paying or receiving only the balance between the contract price and the spot price. Therefore, you can make a deal even when you don't have the actual commodity to sell or the money for payments at the time of contracts (see Figure 1 and 2).

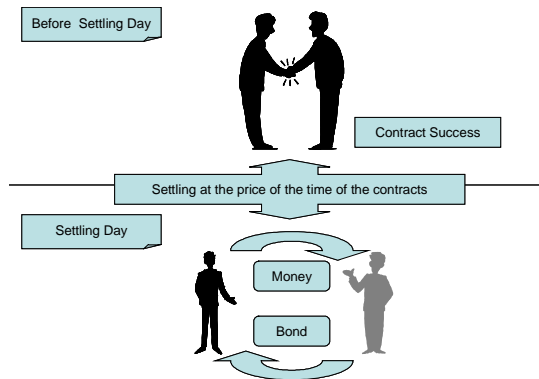


Figure 1

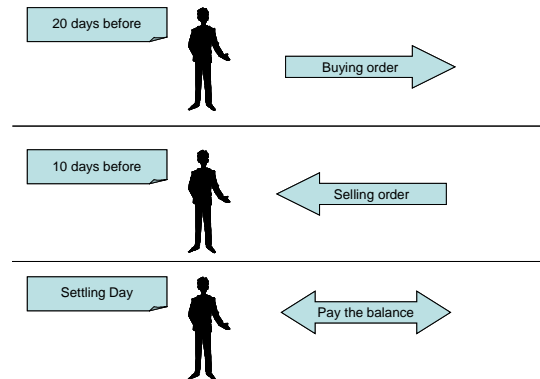


Figure 2

The contracted orders are called "open positions". A participant of a futures market has to settle the balance between buying and selling open positions ("position balance") at the due date. The overall status of open positions (buying or selling, and its quantity) of a member is simply called "position".

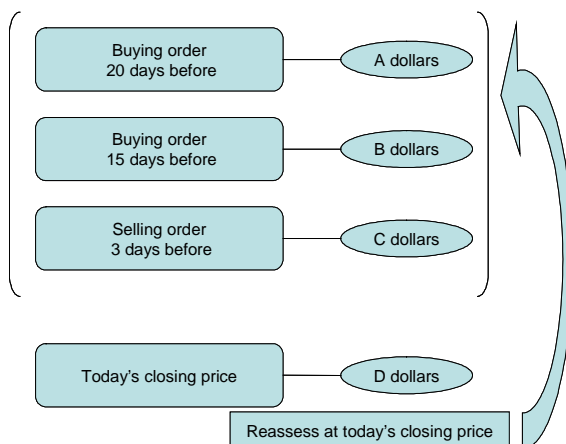


Figure 3

In futures market, participants are required to deposit the margin money of 2 to 5 % of trading amount. The position of each participant is daily revaluated to calculate the profit or loss caused by the price fluctuation of that day (see Figure 3). This process is called "mark to the market". As a result of marking to the market, the account balance of margin money increases or decreases. When the margin money falls short of the minimum amount, the participant is required to deposit additional margin money. This scheme guarantees the fulfillments of contracts.

1.2 The Roles of Futures Markets

Futures markets have a variety of roles. Morishima (1984) discusses the following roles of futures markets:

a) Leveling of relative prices

In futures markets, relative prices tend to be leveled through arbitrages. The exchange deals with futures and spot transactions of various delivery months. The difference between the futures price and the spot price of a commodity should be fairly small.

For example, suppose the futures prices of a commodity are as below:

the futures price at the end of current month: 12,000 yen, and
the futures price at the end of next month: 10,000 yen.

A speculator may predict that the futures price at the end of next month will go up to 11,000 yen since the price is too low in comparison with the price at the end of current month. Then this speculator will:

sell 100 units of the current month in 12,000 yen, and
buy 120 units of the next month in 10,000 yen.

The speculator does not suffer a loss since these transactions form a pair of buying and selling in the same amount of 120 million yen. When the futures price of the next month becomes 11,000 yen after several days, the speculator buybacks 100 units of the current month and sells 120 units of the next month.

buy 100 units of the current month in 12,000 yen, and

sell 120 units of the next month in 11,000 yen.

This series of transactions makes marginal profit of 120,000 yen.

Arbitrage like this raises the futures price at the end of the current month and pull down the futures price at the end of the next month. This is how the leveling of relative prices is accomplished through futures transactions.

b) Increasing the trading amount of real commodity

Even when the real commodity is not traded because of the big difference between the supply and the demand prices, the speculative sales in the futures market are more likely to match with the demand price of the real commodity. When a speculator made short sales in futures market, he/she must procure the real commodity at the expiry date. The speculator suffers a loss in this case, however this can increase the trading amount of real commodity.

c) Hedging

Hedge transactions are the reverse transactions in futures market in order to protect against losses caused by price fluctuation in stock, commodity, or foreign exchange transactions. For example, when you export a commodity and receive the payment in Japanese Yens, you can protect against losses caused by fluctuations of exchange rate by selling the same amount of Japanese Yens in futures market in advance.

1.3 Japanese Stock Index Futures Trading

Stock indices are calculated as a weighted average of multiple stocks and its price fluctuation is relatively stable than the prices of real stocks. Stock index futures trading are commonly used for risk hedging purposes in stock investment.

There are mainly two types of stock indices: **simple average indices** and **capitalization-weighted indices**. The simple average indices represent the level and the fluctuation of market price; the capitalization-weighted indices represent the transitions of the market value. In world markets, capitalization-weighted indices of selected stocks are preferred to simple average or all-stocks indices.

In stock index futures trading, actual stocks are not delivered because it only deals with an abstract numeric value of stock indices. Therefore, stock index futures transactions are settled with the balance even at the expiry date. As described in "A Guide to Stock Price Index Futures Trading" issued by Osaka Securities Exchange,

stock index futures trading play the following roles in addition to the roles of futures markets:

1. To provide opportunities to hedge the price fluctuation risk of stock market for investors such as institutional investors who hold many kinds of stocks,
2. To stabilize and enlarge the secondary market through arbitrage transactions between spot and futures,
3. To provide opportunities to protect against underwriting risks, which leads to stabilization and enlargement of the primary market,
4. To improve the quality of price information with the future index prices, which are the independently formed expected prices. For example, the price formation in spot and futures markets can be more accurate, and
5. To provide new investment methods.

The followings are the typical stock indices in Japan:

a) Nikkei Stock Average (Nikkei 225)

Nikkei 225 has been dealt in Osaka Stock Exchange since September 1988. It is the simple average price of the 225 stocks but slightly adjusted to avoid the effects of other factors than market fluctuation, such as stock split, ex-rights of new stock allocation, merger, and reverse split of stocks.

Nikkei 225 is calculated as:

$$\text{Nikkei 225} = (\text{total price of 225 stocks}) / \text{divisor}.$$

The divisor is basically the number of stocks but is adjusted as needed.

Below is an example of divisor adjustment:

Stock A: 1,000 yen,

Stock B: 2,000 yen,

Stock C: 3,000 yen.

In this example, the simple average of these stocks is $(1,000+2,000+3,000)/3=2,000$ yen. If the company C executes 1.2 for 1 stock split, the price of Stock C is $3,000/1.2=2,500$ yen. When the divisor is not adjusted, the simple average is 1,833 yen. However, the cause of this depreciation is the stock split, not the market fluctuation. The divisor should be adjusted as below to eliminate the effects of the stock split:

Adjusted divisor = {current divisor * (total price of three stocks of previous day - price of rights)} / total price of three stocks of previous day.

In this example, the price of rights is $3,000 - 2,500 = 500$ yen. Therefore, the adjusted divisor is $3 * (6,000 - 500) / 6,000 = 2.75$. The average price is correctly adjusted as $(1,000 + 2,000 + 2,500) / 2.75 = 2,000$ yen.

b) Nikkei Stock Average 300 (Nikkei 300)

Nikkei 300 is a capitalization-weighted index of major 300 stocks in Tokyo Stock Exchange 1st Section. This index is developed by Nihon Keizai Shimbun, Inc. and has been dealt in Osaka Stock Exchange since February 1994. Nikkei 300 is composed of large sized firms in consideration of the liquidity and the performance of the firms. It is also well balanced in composition of industries, so the Nikkei 300 is a representative index of both market and industries.

Calculation of Nikkei 300:

Nikkei 300 is calculated by dividing the current aggregate market value of the selected 300 stocks by the current aggregate market value at the base point of October 1st, 1982 and represented it in percentage.

$$\text{Nikkei 300} = (\text{current aggregate market value}) / \text{base aggregate market value} * 100.$$

The base aggregate market value of Nikkei 300 is also adjusted as below to avoid effects of changes on adopted stocks, ex-rights of paid-in capital increase, conversions of convertible bonds or preferred stocks, or merger:

Adjusted base aggregate market value

= original base aggregate market value * (aggregate market value of previous day \pm adjustment) / aggregate market value of previous day.

c) Tokyo Stock Price Index (TOPIX)

TOPIX is the capitalization-weighted index of all stocks in First Section of the Tokyo Stock Exchange. It has been dealt since September 1988 and its base point is the aggregate market value on January 4th, 1968.

TOPIX is calculated as:

$\text{TOPIX} = \text{current aggregate market value} / \text{base aggregate market value} * 100.$

TOPIX reflects the number of each stock because it is composed of all stocks and is weighted on the number of each stock. It is sensitive to the price fluctuation of large sized stocks, but is not to the small sized ones.

d) J30

J30 is a simple average stock index of selected thirty Japanese firms and is developed by Mainichi Newspapers Co., Ltd. The adjustment method of the divisor is same as Nikkei 225. J30 data is available since December 29th. 1989, which is the day that Nikkei 225 recorded its historic high.

The constituents of J30 at the beginning (November 1998) were:

Ohbayashi, Asahi Breweries, Shin-Etsu Chemical, Kao, Sankyo, Takeda Chemical Industries, Fuji Photo Film, Bridgestone, Komatsu, Fujitsu, Matsushita, Sony, TDK, Kyocera, Mitsubishi Heavy Industries, Toyota, Honda, Canon, Ricoh, Dai Nippon Printing, Mitsubishi Corporation, Ito-Yokado, Bank of Tokyo-Mitsubishi, Sumitomo Bank, Nomura Securities, Mitsui Real Estate Development, Yamato Transport, NTT, Tokyo Electric Power, and Secom.

The constituents of J30 since April 23rd. 2001 are:

Ohbayashi, Asahi Breweries, Shin-Etsu Chemical, Kao, Sankyo, Takeda Chemical Industries, Fuji Photo Film, Bridgestone, Ricoh, Hitachi, Fujitsu, Matsushita, Sony, TDK, Fanuc, Kyocera, Canon, Toyota, Honda, Dai Nippon Printing, Mitsubishi Corporation, Ito-Yokado, Bank of Tokyo-Mitsubishi, Sumitomo Bank, Orix, Nomura Securities, Yamato Transport, NTT, Tokyo Electric Power, and Secom.

1.4 Types of Participants in Futures Markets

The reason that futures transactions are needed is to hedge price fluctuation risks. Futures transactions are used by the people who want to fix the amount of payment/receipt in the future and to avoid the effects of price fluctuation up to that date. The people who participate in futures market for this reason are called **Hedger**.

There are two more types of participants in futures market. One is called **Speculator**, who aims at profits by betting on the prediction of price fluctuation in the future. Speculators play roles such as to increase trading volume in the market and to achieve transactions that may not be achieved only by hedgers.

Another type of participants is Arbitrager. They aim at profits from price differences between markets. When U-Mart is operated in parallel with real spot markets, it is possible in theory that the participants of U-Mart trade in real spot market or that traders in real spot market consult U-Mart, but it is not so practical.

In U-Mart, all participants are speculators and no hedger or arbitrager is attended.

1.5 How to Make Orders and Settlements in Futures Markets

This section describes how real futures markets are managed.

1) Placing Orders

The participants place orders by specifying the following items:

- stock name,
- buying or selling,
- quantity, and
- price.

The price can be specified in the following two methods:

- **Market** order: orders placed at the price formed in the market, without regard to how much the price is, or
- **Limit** order: orders placed with the price limit (minimum price on selling or maximum on buying).

A buying order with the price limit **p** is "an order to buy when price is not higher than **p**, otherwise not to buy". A selling order with a price limit **p** is "an order to sell when price is not lower than **p**, otherwise not to sell". In other words, a limit order is accepted only when it is achieved in the price better than the specified price.

2) How orders are contracted

Actual markets handle orders in different ways at or after opening the market.

The following three methods are adopted in Japanese stock markets:

- **Itayose**: This method is normally used at opening of markets. The exchange collects the orders accepted before opening the market, and contracts them at the price that matches selling and buying volumes.

- **Ita-awase:** This is similar method to Itayose, but it contracts the orders at the price that maximizes the trading volume.
- **Intraday:** This method is used after opening of markets. The exchange matches a new order with existing orders as soon as it is placed.

Table 1. An example of Ita-awase

Selling orders				Price	Buying orders			
Trader	Number of limit orders	Number of market orders	Number of accumulated orders		Number of accumulated orders	Number of market orders	Number of limit orders	Trader
						25		a
E	20		85	102	25		0	
D	20		65	101	30		5	b
C	15		45	100	40		10	c
B	10		30	99	50		10	d
	0		20	98	60		10	e
A		20						

Each trader places an order by referring the adjacent contracted price. Suppose that the orders are place as shown in Table 1. Figure 4 below is a graphic representation of Table 1. These plotted lines are the famous supply and demand curves.

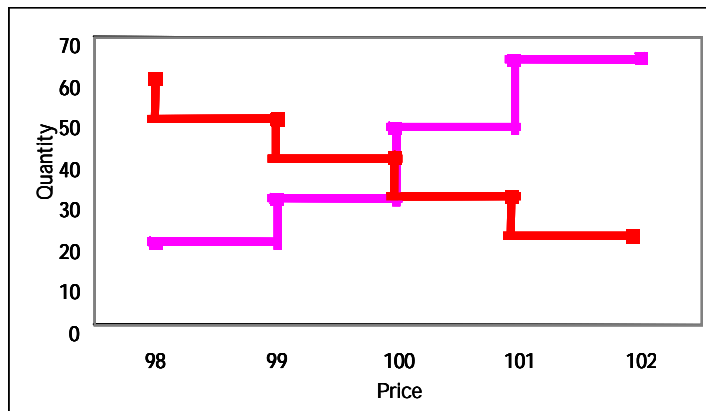


Figure 4

In this example, Itayose method accepts additional orders and contracts the orders at the price that conforms the numbers of selling orders and buying orders (for example, the orders at the price of 99 are contracted if 20 more selling market orders are placed). Ita-awase method contracts at the price of 100, which maximizes the number of contracted orders.

2 U-Mart System

In this section, we describe U-Mart system. U-Mart is designed based on actual futures market systems, but it is much simpler than the actual markets to avoid too much complexity. This section only gives an outline of U-Mart system. For more details of the system, see "How to Participate in U-Mart Experiment System" and "An Introduction to U-Mart".

2.1 Placing Orders

The members (trading programs) who participate in U-Mart are given a certain amount of fund (margin money) at the beginning of experiments. Each member aims at making profit from this fund by trading in U-Mart.

The members place orders by specifying the following items:

- stock name,
- buying or selling,
- quantity, and
- price.

Both market and limit orders are accepted in U-Mart system.

2.2 Contract

U-Mart repeats Itayose at regular intervals, which facilitates synchronization of transactions even when an experiment is conducted via network. See "An Introduction to U-Mart" for the details of the algorithms to determine price, quantity, and orders to be contracted in Itayose method.

2.3 Margin Money, Mark to the Market, and Bankruptcy

In U-Mart, participants receive a fixed amount of margin money at the beginning. At the end of every simulation day, open positions of each participant are revaluated based on the closing price (mark to the market). A participant goes into bankruptcy and is not allowed to make any more deal when the balance of the margin money goes negative as a result of marking to the market. The exchange takes over the transactions of bankrupt members and make settlement on due date.

2.4 Settlement

Members need to settle their open positions on the due date. Open positions are evaluated with the spot price (the actual price of the index at the due date) and settled

at the balance between the futures prices and the spot price.

2.5 Exchange Server

Figure 5 shows the administrative screen of the U-Mart exchange server. The upper left window is the price fluctuation chart that is also provided in GUI clients. The upper right window indicates the result of each Ita-awase (supply and demand curves). The lower left window provides the list of participants and their asset situations. Figure 6 shows the configuration screen that allows the administrator to select the period of time-series price data to be used for each simulation.

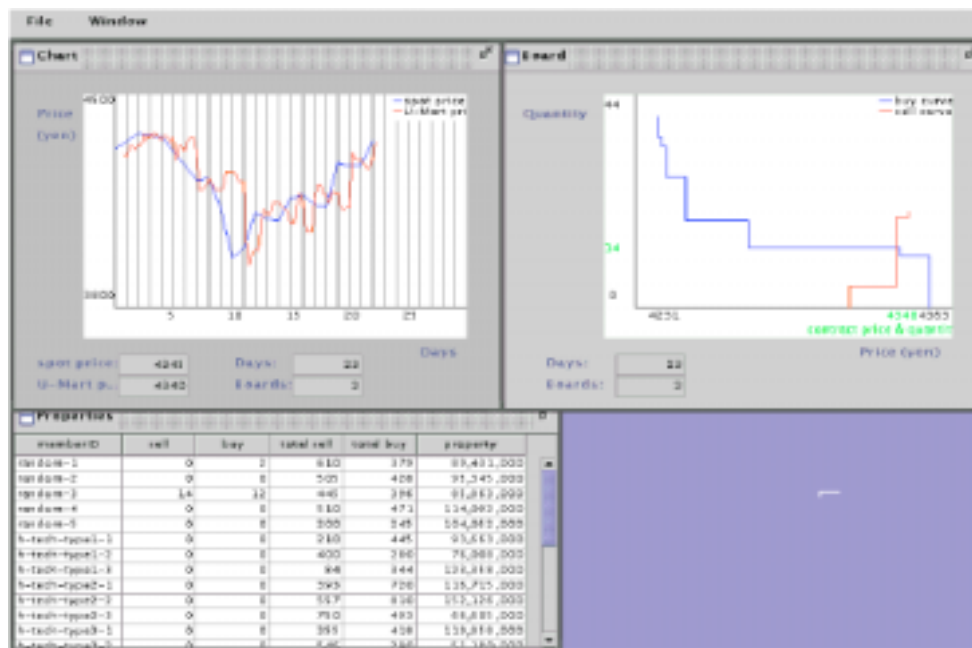


Figure 5

Set up market schedule and spot price data

days per term: 30

boards per day: 4

interval time: 25 sec

spot data file: j30.txt

starting date: 99/10/01 YY/MM/DD

start server after: 30 sec

Start

Default

Quit

Figure 6

2.6 GUI Client

Two types of agents are allowed to participate in U-Mart virtual market: machine agent and human agent. Human agent can connect to the exchange server simply via TELNET, however we provide GUI client for easier manipulations.

Figure 7 shows all windows of the GUI client. The upper left window indicates the positions the cash balances of today and yesterday. The upper right window indicates the prices in the actual J30 market and in U-Mart. The lower left window indicates profit/loss of each day. The human agent places orders from the lower right window.

The GUI client shown on Figure 7 is written in JAVA and is OS independent, however it may be unstable in the environment with small amount of memory. We also provide Windows based GUI client shown in Figure 8.

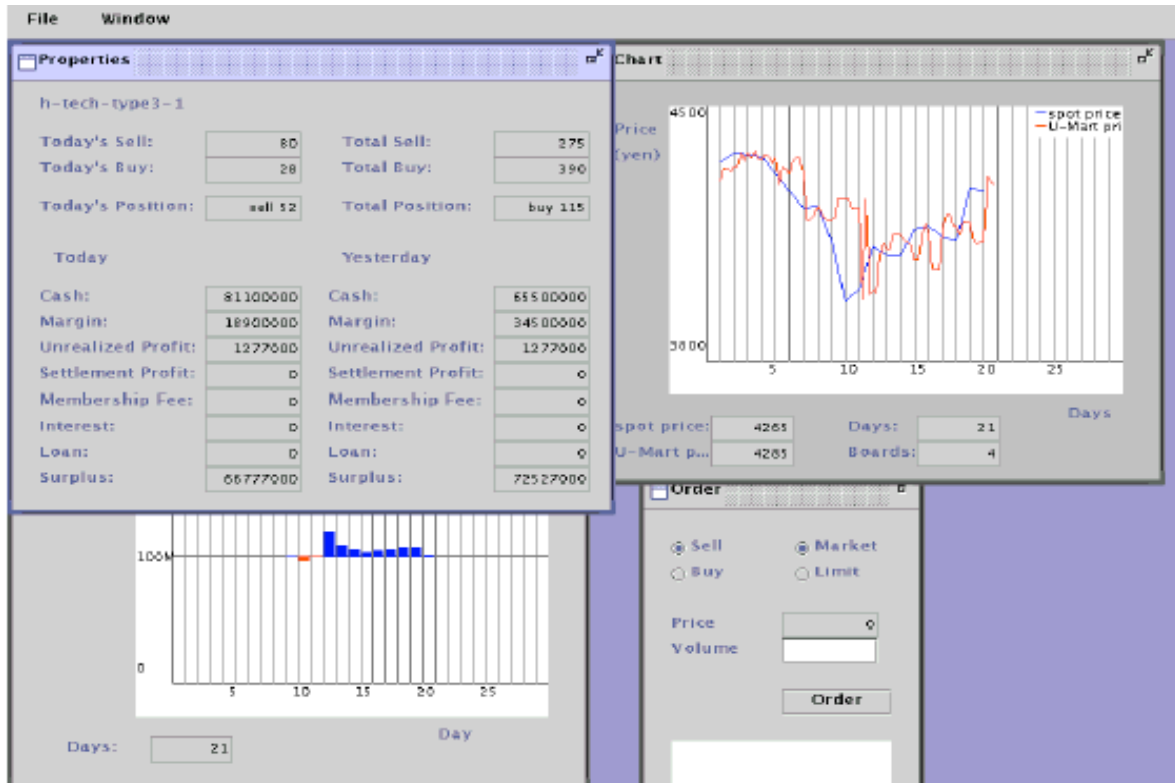


Figure 7

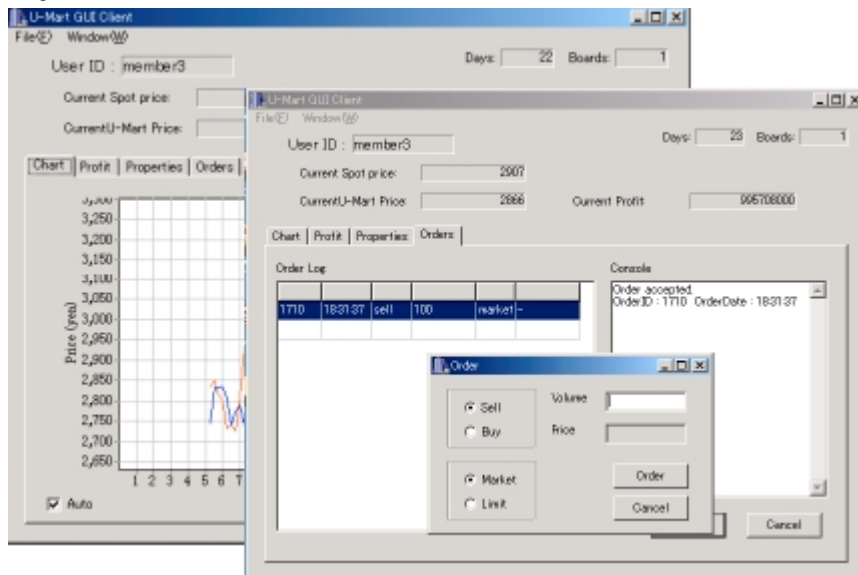


Figure 8

2.7 Machine Agent

U-Mart allows machine agents (computer programs) to automatically make deals in the market. It also allows mixture of human agents and machine agents in one market.

To facilitate development of machine agents, we provide source codes of sample

agents, such as the random agent (who make deals randomly), the trend follower agent, and contrarian agent.

We also provide U-Mart Agent Development Kit. For details of this kit, see "Development of U-Mart Agent Using U-Mart Agent Development Kit (TIT Version)" and "Development of U-Mart Agent for Windows Using U-Mart Agent Development Kit (TIT Version)".

2.8 (Reference) Causes of Violent Fluctuations in Pre U-Mart and Actions Against Them

In Pre U-Mart 2000 held in summer 2000, wide varieties of machine agents participated in the experiments. The variety of agents exceeded the expectation of the economists. However, in Pre U-Mart 2000, we repeatedly found violent fluctuations during public experiments, which hardly occur in actual markets.

This section explains about the mechanism of these violent fluctuations, which is very useful to know before developing machine agents. We also provide some tips to develop agents who resist bankruptcy.

1) Price Fluctuation Mechanism

a) Depth of Market: A Prerequisite

Depth of market is one of the problems found in a number of infant markets including U-Mart. Price fluctuation can be small when large volumes of orders are placed on the periphery of the equilibrium point of supply and demand. However, when only the small volumes of orders are placed on the periphery of the equilibrium point, a small change on the number of orders directly leads to violent fluctuation.

b) Mechanisms of Heavy Rise and Fall

In many of case examples, heavy price fluctuations occur in the following processes. The example below is the case of heavy rise. The mechanism works in inverse direction in the case of heavy fall.

STEP 0 Stable period

When there is no big trend in one direction in the market, the price predictions of the participants are various so that buying and selling orders are well balanced.

STEP 1 "Accidental coincidence" by ransom agents

It is difficult to form prices only by the trend follower types of agents. In U-Mart, machine agents called "random agents" are introduced to facilitate price formation.

They place selling or buying orders randomly at the price \pm several percents of the spot price at the regular contract intervals of 15 seconds.

In the meanwhile, the imbalance between the volumes of selling and buying order fluctuates the price. For example, the price rises when the volumes of buying orders are larger than the one of selling orders. This kind of phenomenon generates the trend of price fluctuation in one direction.

STEP 2 "Amplification" by trend follower agents

Then the agents who follow the trend amplify the price rise generated by random agents. This type of agents continues buying based on the prediction that the price moves in one direction along the trend. As a result, larger volumes of buying orders than selling orders are constantly placed in the market and the price gradually rises.

STEP 3 Extremely imbalanced price prediction and demise of market depth

When most of the participants predict that the price will rise, only the extremely small volumes of selling orders are placed. As a result, supply and demand match at the far left of demand curve (where the price elasticity of demand is very high) and the price rises violently.

STEP 4 Change in price trend

When the price fluctuates in one direction in certain degree, some agents begin to place the offsetting orders to realize the profit. When trade volume is extremely small, orders from random agents exert a strong influence on price formation. As a result, the price trend becomes easier to change.

2) Tips for Designing Agents

a) Position should be well balanced.

An agent goes into bankruptcy if its asset value is evaluated as negative after "marking to the market". Therefore, holding excessive buying (or selling) position means to take huge price fluctuation risk.

Agent should be designed to realize the profit by offsetting selling orders at higher prices and buying orders at lower prices.

b) Trend follower agents should not place market orders.

Market order is useful because it is easier to make deals. However, it is also a dangerous method. For example, a trend follower type of agent can go into bankruptcy in one transaction if it buys (or sells) at the price when extremely heavy rise (or fall)

occurs.

On the other hand, market order may be an effective strategy for contrarian type of agent who goes against the trend (sells when the price is rising and buys when the price is falling).

3 Methods for Prediction

This section introduces prediction method for futures market. There are two things to be predicted: "price" in the future and the "time (timing)" of the price change. It is said that "time" prediction is more difficult than "price" prediction.

There are two major methods for prediction: fundamental analysis and technical analysis. Most of speculators make prediction by combining these two methods (according to the survey conducted by Bank of England in 1989). They are complementary methods, and the fundamental analysis mainly used is for medium and long-term predictions and technical analysis is mainly used for short and medium term predictions.

3.1 Fundamental Analysis

Fundamental analysis is a method to find the theoretically reasonable price based on economic fundamentals. The prices of stocks are often deviated significantly from the theoretical price based on fundamentals. Fundamental analysis is premised on the basic understanding that the price should converge to the theoretical price in medium and long-term, while other factors than fundamentals such as psychological factors affect the price in short term.

The investment style based on fundamental analysis is to buy when the market price is cheaper than the theoretical price and to gain the greater profit than the market performance in the process that the market adjusts the price.

1) Statistical method

This is the method to reject explanatory variables through regression analysis on correlation between various fundamental indicators and the relative return on investment against the market.

However, it is impossible that statistical hypotheses are strictly satisfied because social and economical environments are changing consistently.

The fundamental indicators include:

a. Financial indicators:

such as revenues, net assets, dividends, growth rates, and potentialities of firms,

b. Macroeconomic indicators:

such as business indicator, industrial production index, Marshall's k (money supply/nominal GDP), foreign currency reserves, long-term interest rate, short-term interest rate, and exchange rates, and

c. Risk analysis:

such as country risk analysis, ratings of firms, portfolio selection (selections of assets).

One example of statistical analysis is Capital Asset Pricing Model (CAPM).

CAPM is a simple model used for price predictions. It divides the expected return rate of an asset into risk-free interest rate (such as government bonds) and the expected return rate of the entire market.

In here, the expected return rate of an asset A is r_A , the risk-free interest rate is r_F , and the expected return rate of the entire market is r_P .

The expected return rate r_i is calculated as:

$$r_i = \frac{p_1 + d - p_0}{p_0},$$

where, p_1 is the price in the next term, d is the dividend of the current and the next terms, and p_0 is the price in the current term.

In here, calculate the regression formula below:

$$r_A - r_F = \beta (r_P - r_F)$$

β is the beta risk. It is also called systematic risk since it is the ratio to the risk of entire market. In futures trading, you only reserve buying or selling and you do not have asset yet. Therefore, the expected return excluding the risk-free asset part is added to the futures price, which means that the futures price rises if $\beta > 0$, falls if $\beta < 0$, and stays the same if $\beta = 0$.

b) Investment criteria

- Dividend yield: the expected dividend per share divided by the stock price.
- Price Book-value Ratio (PBR): the stock price divided by the net asset per share in

book value. It is a judgment criterion to sell if the value is greater than 1 or to buy if the value is smaller than 1. However, net assets stated on the reports such as quarterly corporate report are not accurate because they are not calculated in market values.

- Price Earnings Ratio (PER): the stock price divided by the earnings per share. Compare this value with the market average PER (it is various depending on country and period) and judge if the stock is comparatively cheap. However, this criterion is said to be useless in Japan because most of the investors in Japan do not consult with PER.

c) Comprehensive approach based on practical experiences

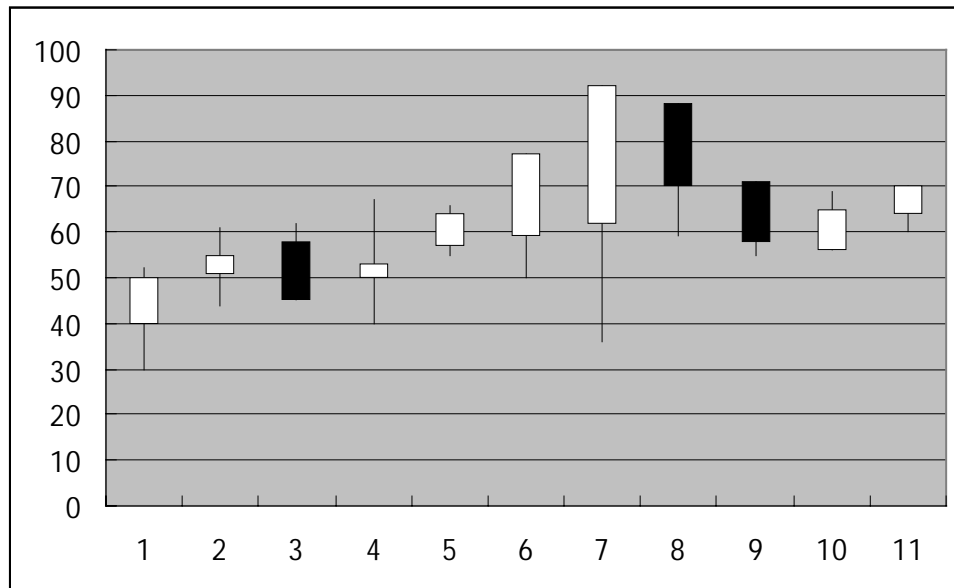
This is a method to make judgments based on the speculator's practical experiences with reference to the various fundamentals information. The judgments with this method are naturally biased.

3.2 Technical Analysis

Technical analysis is a method to predict market prices based on the prices in the past, the time period, and the traded volume. It may also be understood as "highly elaborated heuristics". Technical analysis does not consider complicated cause-effect relationships of price formation. It predicts the future trend from the price fluctuation in the past on the presuppositions that "the price movement forms the trend" and "the price fluctuation has some kind of patterns repeated in time-series".

Technical analysis is facile and handy and is used very often, while most of economists consider it as an irrational method. Many people develop their original methods so that there are uncountable numbers of methods. Technical analysis is mainly used for short and medium terms prediction.

a) Bar chart



Bar chart is a technique to represent price fluctuation in charts. It enables us to grasp opening, closing, highest, and lowest prices at a glance. Black and white boxes indicate the opening and the closing prices. Black boxes mean the price of the period has dropped (opening > closing) and white boxes mean the price of the period has risen (opening < closing). The highest or the lowest price of the period is indicated by thin solid line if it is out of range represented by black or white box.

b) Trend line

Trend lines are the straight lines drawn by connecting peaks of the price fluctuation line to grasp the direction of trend in medium and large scales. Usually, irregular values in detail are ignored. It may be an arbitrary method that requires some kind of knacks to draw the line.

c) Eliot wave

Eliot wave is the idea that market price complies with the Fibonacci numbers and the golden section, and it rises in five waves and drops in three waves. The characteristics of Eliot wave are: the wave is more likely to expand 1.618 times bigger, and the third wave is the most likely to expand. It is also similar to the market theory based on Mandelbrot's fractal.

d) Moving average

Moving average is a method that daily calculates the average of closing price in the past several days and draws time-series chart. The average can be a simple average or an average weighted more on the most recent price. Draw multiple average lines with different number of dates. It is a signal to buy when short-term line crosses medium and long-term lines from the bottom up (golden cross), or the opposite (dead cross) is a signal

to sell.

e) Dow theory

This theory was developed by Charles H. Dow based on his empirical rules. The Dow-Jones average was developed based on this theory. It is a method for medium and long-term analysis that pays attention only on closing prices.

3.3 (Reference) Reflexivity Theory of George Soros

This section introduces an investment theory of George Soros. He is commonly believed as one of the investors who have achieved the world's best performance. His theory is short on specifics and very abstract. However, it should be remarked that his theory is premised on the idea that market, investors, and even he "always make mistakes". He puts emphasis on finding turning points of the trend that is generated by those biases.

- 1) Trend is generated through the interaction between fundamentals and investors' biases. At this stage, the trend is inexplicit to most of the people.
- 2) Some investors who find the trend initiate the self-reinforcing process.
- 3) The directionality is tested repeatedly and is confirmed eventually.
- 4) The confidence on the directionality is amplified (the bias of expectation).
- 5) Consequently, people stop paying attention to the gap between the reality and their cognitions (the expectation changes to belief).
- 6) Climactical rise or fall occurs (boom).
- 7) The deep remorse for excessive rise or fall initiates the self-reinforcing process in reverse direction (burst).

Reflexivity is the concept that a reflexive feedback mechanism works between thinking and reality. The reflexivity theory considers that subject (investor) and object (market price) of thinking are not independent one another and the trend is generated by the biases of thinkers. It also considers that not only the fundamentals form the stock prices but also "the stock prices affect the fundamentals".

Soros points out an important difference between social and natural sciences as that "social science recognize the thinking as a part main subject, while natural science deals with phenomena that occur independently from "who think what". This is the interaction between individuals and environment. When this is applied to markets, the reflexivity is the interaction between markets and investors. This reflexivity makes the market situation more complex and generates and amplifies the biases of investors.

Reference

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Glossary

- Spot trade: a trade that the contract is executed in short term.
- Futures trade: a trade to promise the delivery of a good at a certain point of time in the future at the contracted price.
- Hedge (risk hedge): to fix the profit by making combination of transactions (spot sales and futures purchase or spot purchase and futures sales) in order to avoid price fluctuation risk in the future.
- Delivery month: a deadline to deliver the actual commodity.
- Buying position: a promise to buy in futures trade.
- Selling position: a promise to sell in futures trade.
- Open position: a general term for unexecuted contract without distinguishing buying or selling.
- Position: the current asset situation of open positions after marking to the market
- Reverse transaction: a transaction opposite to the current position. Selling transaction when you hold buying position. Buying transaction when you hold selling position.
- To close one's position: to clear the current position by making reverse transactions.
- Margin money: the money deposited to the exchange as a source for net settlement.
- Mark to the market: to reevaluate the current position and settle the profit or loss caused by the price fluctuation. The balance of margin money is adjusted depending on the result of mark to the market.
- Bar chart: a chart to indicate time series fluctuation of opening, closing, highest, and lowest prices.

- Fundamentals: fundamental economic criteria such as GDP growth rates, interest rates, rate of return.
- Limit price: Some markets put limitations on price movement per day to prevent overheating of speculations. It is called "limit-high" when the price rises up to the limit and "limit-low" when the price falls up to the limit.

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