How expert dealers make profits and reduce the risk of loss in a foreign exchange market?

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Abstract

The paper clarified how actual expert dealers made profits and reduced the risk of loss in a virtual foreign exchange market, by comparing the way novice or general investors showed. As a result, we could find that the experts were risk-averse for losses and risk-seeking for profits while the novices showed the opposite behavioral tendency. This result was analyzed in terms of the prospect theory: It was found that the expert could be (partially) free from deposition effect and sunk-cost effect while the novices were not. It was also suggested that the experts' strategy of dumping losing currencies could be socially transmitted by the dealers' managers.

Introduction

How people make decision and learn in dispersed complex social systems has recently been considered important to be investigated. Here a dispersed complex social system is defined as a system without a centralized information resource and mechanism for deciding its behavior and, at the same time, with rapidly changing environments which provide their decision makers with information that continually changes. In this paper, we will focus on the (spot) foreign exchange market as a typical example of the complex social systems. This is because (1) the foreign exchange market have, as their constituents, a lot of market players (such as banks, investors, governments, and so on) who are different from one another in investment motivation, speculation, and stake etc., (2) it is not a centralized market, as the stock market, so that its market players have to fathom out market consensus based on limited information, and (3) it has rapidly changing environments which provide its decision makers with information on the order of seconds – the rate of change is typically faster than the decision makers can respond. So it is considered a good target of cognitive research to clarify how expert or skilled dealers make decisions, especially make profits and reduce the risk of loss, in the exchange market.

How can we investigate the process of expert dealers' decision making? For this purpose, experimental market (or economics) approach (for instance, Friedman & Sunder, 1994) seems useful: Experimental market is the field that attempts to understand the behaviors of the markets and their players by conducting experiments using real human subjects. From a cognitive perspective, the experimental market approach can be used to clarify the way of human biased decision making, by analyzing how market players actually make decisions in their conducting transactions on a virtual financial market that simulates the corresponding real market (Smith, 1996; Ueda, Taniguchi & Nakajima 2003). Namely, from the result of such a cognitive experiment on the markets, it is considered to understand how people or market players make decisions, in the real markets, under some biases such as representativeness (Kahneman & Tversky, 1972). This paper also adopts this **cognitive experimental market approach,** as its research methodology, in order to clarify what kind of biases influence expert dealers' decision making (profit making and risk hedge) in a virtual exchange market. We will pursue this research target, specifically by comparing the performance of expert or skilled dealers with that of novice or general investors.

There are some previous studies using the cognitive experimental market approach. For example, the U-Mart project aims to analyze the behaviors of the market, especially the conditions under which bumpy ride occurs, using a virtual future stock market (Kita, Sato, Mori & Ono 2003; Ueda, Taniguchi & Nakajima 2003). Because human players, as well as computer agents, participated in a series of experiments, it is possible to analyze the relation between the macroscopic behaviors, such as price fluctuation, of the market and the microscopic features of human players, which has not been realized yet.

Smith (1996 & 1997) analyzed, using three trained dealers as his subjects, how they reduced risks in dealing on a virtual spot currency market and proposed a feedback-control model of their risk management. Because he did not

compare the performance of his skilled subjects with that of novice or general investors, he did not clarify what kind of biases the skilled dealers had or were free from. In addition, it is a question that his subjects were actually expert dealers. In the experimental environment used in (Smith 1996; Smith 1997), each skilled subject was asked to make deals with a pre-installed computer dealer while, in that used in (Izumi, Nakamura & Ueda 2002), subjects were asked, in pairs, to make deals with one another through computer network, which virtually realized human-human dealing. In this sense, the latter environment can be said to be closer to the real dealing situation than the former. However, it is also a question that all of their subjects were actually expert dealers.

So, in this paper, we will ask real expert dealers to participate in our experiments and compare their performance with novice or general investors' one. Here, "expert" dealers mean those who had engaged in currency dealing or stock trading for more than five years, since this business field is a competitive jungle so that "engaging for five years" can be an index of being expert or skilled. On the other hand, we will ask graduate students majoring in economics to participate, as novice or general investors, in our experiments. Under this circumstance, we made two experiments in order to clarify how and under what kind of biases the expert dealers make profits and reduce the risk of loss in a virtual foreign exchange market. In this virtual market, only dollars and yen will be dealt.

This paper will be constructed as follows: In the second section, necessary terminology will be introduced. In the third and fourth section, the method of two experiments, which were made to clarify dealers' decision making, and their results will be explained. In the fifth section, the results obtained will be discussed from the perspective of the prospect theory (Kahneman & Tversky, 1979). In the final section, this paper will be concluded.

Terminology

Before we will explain our experiments, technical terms necessary for understanding dealers' trading behavior should be introduced.

Position: We will use this term from the point of the amount of dollars that each dealer has. "Long" means owning or holding dollars (i.e., the amount of dollars bought exceeds that of dollars sold). "Short" is the opposite of a long position. "Square" means the situation that the amount of dollars bought is equal to that of dollars sold. In our experiments, all the subjects were asked to start from the square position and to go back to the square at the end of the experiments.

Unrealized profits and losses (UPL): An increase/decrease in the value of dollars that is not "real" or "unrealized" because the dollars have not been sold. Once dollars are sold by a dealer, the profits/losses are "realized" by the dealer. If a dealer started from the square and bought one dollar at the rate of $1=Y100 and, after that, the rate has changed to $1=Y110, the dealer has Y10 as UPL, which will be realized when he/she sells the dollar to get back to the square. In our experiments, the performance of each dealer will be estimated in terms of UPL.

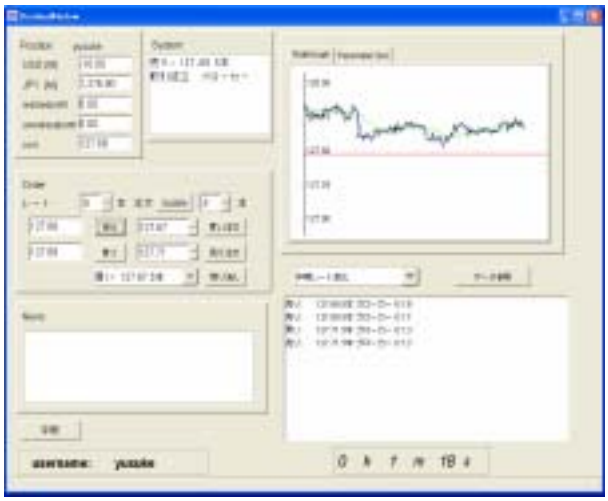

Figure 1: The user display of VDS (stand-alone type).

Lengthening vs. liquidation, profit-taking vs. loss cut: In this paper, such a dealing that the absolute amount of position increases is called "lengthening" while such a dealing that the absolute amount of position decreases is called "liquidation". Because it is related to dealers' risk management, the latter will be analyzed in detail. Moreover, liquidation can be divided into two sub-categories: profit-taking and loss cut.

Experimental Environment

The virtual dealing system (for abbrev., VDS; see Figure 1)[1], which we originally developed using Java language, was used in our experiments. The VDS was constructed so that users (subjects) could make dealings with one another through computer network; it simulates the functions and display of the actual dealing systems, such as Reuter 2000, so that users can get various fundamental information, such as interest rates and balance of trade, news and trends to buy and sell dollar/yen with other users or a broker[2].

The VDS is available both as a server-client system, in which multiple users make dealing with one another, all at once, through computer network, as is actual dealings, and as a stand-alone system, in which only one user makes dealing with the system's broker, as was in the experiment by Smith (1996 & 1997). In Experiment 1, it was used as the server-client system while, in Experiment 2, it was as the stand-alone system.

The VDS is designed so that we can get various users' dealing logs: For example, logs about what type and amount of dealing a user made at which time, and those about what type of information, news or trends a user referred to in his/her dealing. Therefore, by using the VDS, we can

[1] Because it was so built that the Japanese dealers would use, this VDS has Japanese signage, as denoted in Figure 1.

[2] Only one broker is assumed to exist in this VDS.

analyze what type of decision a user made referring to what kind of information.

Experiment 1

Purpose

The purpose was to make a hypothesis about how expert dealers made profits and reduced the risk of loss in a virtual foreign exchange market, by comparing the performance of the expert dealers with that of novice or general investors. The target was a dollar-yen exchange market, as already explained. Because this experiment aimed to explore a hypothesis about the way experts made decision, the server-client system was used so that it could provide the subjects with a dealing environment similar to the actual one.

Subjects

Eleven dealers, who had engaged in actual dealing or trading for more than five years, participated as "expert" dealers (we call this group of subjects **expert group**) while ten graduate students, who majored in economics, participated as "novice" or "general" investors (we call this group of subjects **novice group**).

Procedure

All the subjects of each group were gathered together, at a time, into one meeting room; the experiment of the expert group and that of the novice one were made independently.

The news and fundamental information given to the two groups were the same actual data during August, 1997; in the first half of this period, the rate was gradually moving up while, in the latter half, it rapidly and sharply declined, which was caused both by a decline in U.S. stock prices and by Japan's current account surplus. The rate change during the experiment was not calculated endogenously, i.e. as a result of dealings in the VDS, but given exogenously, i.e. the same as the actual change during this period: This was because the rate would have fluctuated quickly if the rate change had been endogenously calculated in such a dealing environment only with small number of market players. All the subjects were, in fact, given such an instruction that exchange rates were calculated by the orders of participating players, since the dealing environment of the experiment needed to be as close to the actual one as possible.

The subjects of each group were first explained about how they could use the VDS interface and make dealings through the VDS for 30 minutes. They were then given the information about the economic situation and fundamentals just before August, 1997[3]. After that, they were asked to make dealings through the VDS for 20 minutes[4].

[3] Because all the names of the currencies dealt, the target nations, and the proper names that came on were renamed, all the subjects did not notice that the rate and data given were the actual ones in the past. Of course, during the experiment, news was, from time to time, given to the subjects while the data of economic fundamentals and the trends of rate were always available.

[4] The events occurred in August, 1997 was compressed in the time frame of 20 minutes.

The data collected were the logs of each subject's positions, orders, referred economic information and messages of chatting, through the VDS, with other subjects.

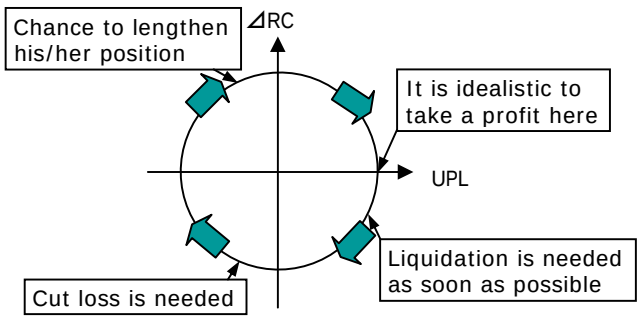

Figure 2: The risk space.

Method of analysis

The main purpose of the experiment was to make a hypothesis about how the respective groups made profits and reduced the risk of loss. So, for each subject, we plotted every log of dealing on the risk space (Smith, 1996): The risk space[5], which has an x-axis that denotes the value of UPL[6] for each dealing and has a y-axis that denotes the rate-of-change (RC) of exchange rates whose sign shows the increase in the absolute value of UPL[7], visualizes how each subject managed the risks caused by taking his/her positions (see Figure 2). By comparing the risk spaces of the expert group with those of the novice one, we can analyze how the expert dealers made decisions, especially reduced the risk of loss.

Result

Typical examples of the risk spaces plotted for the expert and the novice group are shown respectively in Figure 3 and 4; in these figures, a circle denotes buying dollars, a upside-down triangle does selling dollars, blue color does lengthening and red color does liquidation. From the nature of the figures, the lines of the graphs will extend towards high positive values of the x-axis if a subject waits to lock in profits after enough profits are made; in the same way, the lines will extend towards high negative value of the x-axis if he/she is so slow in cutting losses. Therefore, the higher the average profit is, the slower a subject tends to be in taking profits; the higher the average loss is, the slower he/she tends to be in cutting losses.

From these figures, we can find a tendency that the novices cut losses later than the experts. So, to statistically confirm the above, we calculated the average loss and profit respectively for the two groups in order to compare the average loss (or profit) of the expert group with that of the novice one. As a result, as for the average loss, we could

[5] The risk space used in this study was a little different from that used in (Smith 1996).

[6] The value of UPL was normalized, being divided by the amount of the maximum position of the subject.

[7] When a subject's position is long, $\Delta RC>0$ if dollar appreciation occurs while $\Delta RC<0$ if yen appreciation does.

find significant difference between the two groups (expert = -0.02854 (SD = 0.00035), novice = - 0.12315 (SD = 0.01124); p = 0.041<0.05, one-sided) while, as for the average profit, we could find no significant difference between the two groups (expert = 0.46511 (SD = 0.03293), novice = 0.37609 (SD = 0.02344); p = 0.190, one-sided).

From the above result, it is possible that experts can cut losses so fast that they may prevent the losses from increasing and, at the same time, can take profits at the right time while novices cannot: This is, however, considered to be little better than a hypothesis. It is because, as for the average profit, the number of dealings was so scarce that we could find no significant difference and because this result may be specific to a set of the exchange rate and news given to the subjects (hereafter, we call this set "scenario"). We therefore need to make an additional experiment to confirm the hypothesis obtained, with augmenting the number of dealings: The reason the number was small is considered to be attributed to the experimental environment of face-to-face dealing because almost all the expert subjects were acquainted with each other so that they, for a while, hesitated to make dealings. So we will make an experiment, as Experiment 2, by using a stand-alone type of VDS.

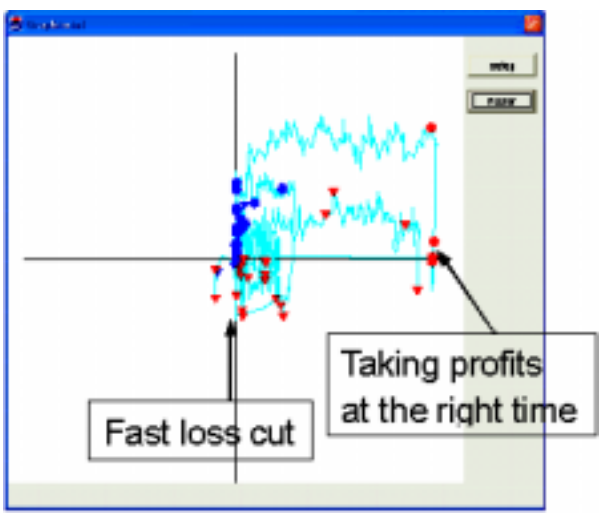

Figure 3: An example of the risk space of expert.

Figure 4: An example of the risk space of novice.

Experiment 2

Purpose

The purpose was to confirm the hypothesis derived from the result of Experiment 1: The hypothesis was that expert dealers could cut losses so fast that they might prevent the losses from increasing and, at the same time, could take profits at the right time while novices could not. Because of the reasons explained above, a stand-alone type of VDS was used in this experiment.

Subjects

Ten dealers, who had experienced more than five years' dealing, participated as "expert" dealers (**expert group**) while ten graduate students, who majored in economics, participated as "novice" investors (**novice group**).

Procedure

In this experiment, a stand-alone type of VDS was used so that all the subjects needed not to be gathered together at a time; each subject participated in this experiment independently. They were asked to make dealings with a computer dealer (computer-driven trading program) of the VDS.

The scenario (news and fundamental information) given to the two groups were the same actual data during September, 2000; through this period, the exchange rate showed a box or range rate, i.e. the rate fluctuated within the expected range. The rate change during the experiment was given exogenously, as was the same in Experiment 1[8].

All the subjects were first explained about how they could use the VDS interface and make dealings through the VDS for 40 minutes. They were then given the information about the economic situation and fundamentals just before September, 2000. After that, they were asked to make dealings through the VDS for 50 minutes.

The procedures other than the above were the same as those in Experiment 1.

Method of analysis

The same as that in Experiment 1.

Result

We calculated the average loss and profit respectively for the two groups in order to compare the average loss (or profit) of the expert group with that of the novice one. As a result, we could find significant difference between the two groups, both as for the average loss (expert = -0.01849 (SD = 0.00010), novice = - 0.031 (SD = 0.00005); p = 0.029 < 0.05, one-sided) and as for the average profit (expert = 0.09915 (SD = 0.00086), novice = 0.03619 (SD = 0.00013); p = 0.003 < 0.01, one-sided).

So our hypothesis was confirmed: We can say that the experts could cut losses so fast that they might prevent the losses from increasing and, at the same time, could take

[8] All the subjects were, in advance, informed of it.

profits (or lock in profits) after enough profits were made, whereas the novices could not.

Discussions

Analysis in terms of the prospect theory

From the results of the two experiments, we can say as follows: Expert dealers can cut losses so fast that they may prevent the losses from increasing and, at the same time, can take profits (or lock in profits) after enough profits are made. On the other hand, novices seem to be reluctant to sell currencies that lose value while they are inclined to lock in profits no sooner than the currencies they hold are profitable. Why is there a sharp contrast between the way experts make decision and that the novice do?

To answer this research question, we will introduce the prospect theory by Kahneman & Tversky (1979): The theory shows, based on the results of a laboratory experiment, that people's attitudes toward risks concerning profits may be quite different from their attitudes toward risks concerning losses. Namely the theory claims that people are, in general, risk-averse for profits and risk-seeking for losses.

By using the theory, the tendency that people are reluctant to lock in profits even when the losses increase while they are willing to do no sooner than their holdings become profitable can be explained by "deposition effect" (Shefrin & Statman 1985; Weber & Camerer 1998) and "sunk-cost effect" (Kahneman & Tversky 1979): The former means that people prefer certainty to uncertainty over a reference point while they show the opposite preference under a reference point. And the latter means that people tend to overestimate the cost needed for making a position; decision-makers are unduly influenced by resources that have already been spent and are therefore more likely to continue pursuing a previously chosen course of action.

This theoretical explanation seems to be true of the dealing behaviors of our novice subjects, because they sold promising currencies or winners too early and rode unpromising currencies or losers too long. That is, our novice subjects were considered not to be free from the biases of deposition effect and sunk-cost effect. On the other hand, our expert dealers seemed to avoid being distorted by these biases, because they could cut losses early and wait to lock in profits after enough profits were made.

Then the next question arises about whether expert dealers can be completely free from the biases. To clarify this point, we analyzed the dealing data in more detail. As a result, we could find that some expert dealers sometimes showed stepwise profit taking (see Figure 5). This stepwise way of profit-taking can be interpreted in two ways: One is that this indicates partial irrationality, which is subject to the biases, of their dealing behaviors and the other is that they were forced to take profits stepwise and to hedge risks caused by rapid price fluctuation because they could not fully predict the future exchange rate. Anyway, it can be said that even the expert dealers were not wholly free from the biases.

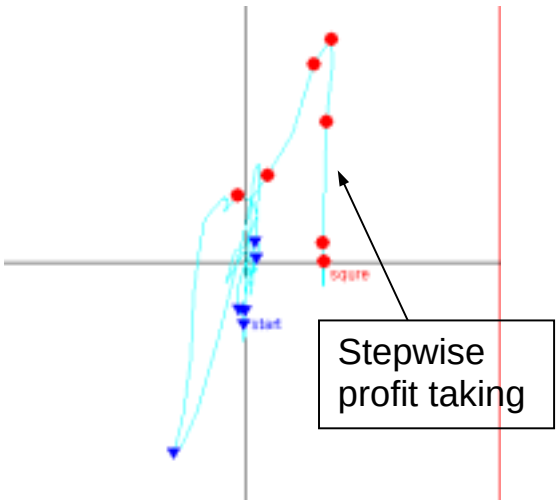

Figure 5: An example of the stepwise profit taking that some of the experts showed.

We also asked two investment managers why expert dealers can be free from the biases. Both of the managers said that dealers were taught, by their managers, to sell losers as early as possible because riding losers too long would only compound their losses, which might develop into a major management issue. On the other hand, the managers did not explicitly teach how to make profits. If this holds of dealers in general, it is possible that expert dealers have socially learned to be free from the biases. The investment managers added that a lot of dealers in the making had to drop out because it was quite difficult to learn to be free from the biases, which seemed easy on the surface.

To sum up, expert dealers can be (partially) free from the biases, in their decision making, that a lot of people are considered to have (Kahneman & Tversky 1979). This clarification, by using actual expert dealers as subjects, is the main contribution of this paper.

Conclusion

How people make decision and learn in dispersed complex social systems has recently been one of the important research issues. Especially the way of decision making needs to be investigated in real situations or settings. So, in this paper, we focused on the (spot) foreign exchange market as a typical example of the complex social systems and clarified how and under what kind of biases the expert dealers make profits and reduce the risk of loss in a virtual foreign exchange market. For this purpose, we asked real expert dealers to participate in our experiments and compared their performance with novice or general investors' one.

Our two experiments showed that the expert dealers could cut losses so fast that they might prevent the losses from increasing and, at the same time, could take profits (or lock

in profits) after enough profits were made. On the other hand, novices were reluctant to sell currencies that lost value while they were inclined to lock in profits no sooner than the currencies they held were profitable.

We analyzed this result in terms of the prospect theory (Kahneman & Tversky 1979). The prospect theory claims that people tend to sell promising currencies or winners too early and ride unpromising currencies or losers too long, under the influence of deposition effect and sunk-cost effect. This theoretical explanation was clarified to be true of the dealing behaviors of our novice subjects. On the other hand, it was also clarified that our expert dealers could avoid being distorted by the biases. In addition, it was possible that even the expert dealers were not wholly free from the biases because some of them showed stepwise way of profit-taking, which was considered not fully rational.

"Artificial market" research (Arthur, 1991) attracts attention of many researchers in recent years. In the artificial market research, computer programs as virtual market participants are built and simulated, where these computer programs mutually trade, for understanding the phenomena and features of real markets. The key is to build an artificial market with the appropriate features of the actual markets and their participants. The result of this paper is considered to be applicable to this artificial market research, especially to the construction of agents with the way of risk management in the artificial market model by Izumi & Ueda (2001). In this way, the result of this research is also of practical use.

Acknowledgments

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