



How Do the Differences Among Order Distributions Affect the Rate of Investment Returns and the Contract Rate

Future University-Hakodate

Shingo Yamamoto . Shihomi Wada . Toshiji Kawagoe



Contents

- The aim and the background
- Introduction of U-Mart
- The method of the experiments
- The results of the experiments



The aim of this research

- We analysed how these following factors affect the contract rate (CR) and the rate of investment returns (RI).
 - Time series of price index (PI),
 - The decision-maker (DM) of order quantity,
 - The distribution of order quantity (OD),
 - Average of order distributions (m).

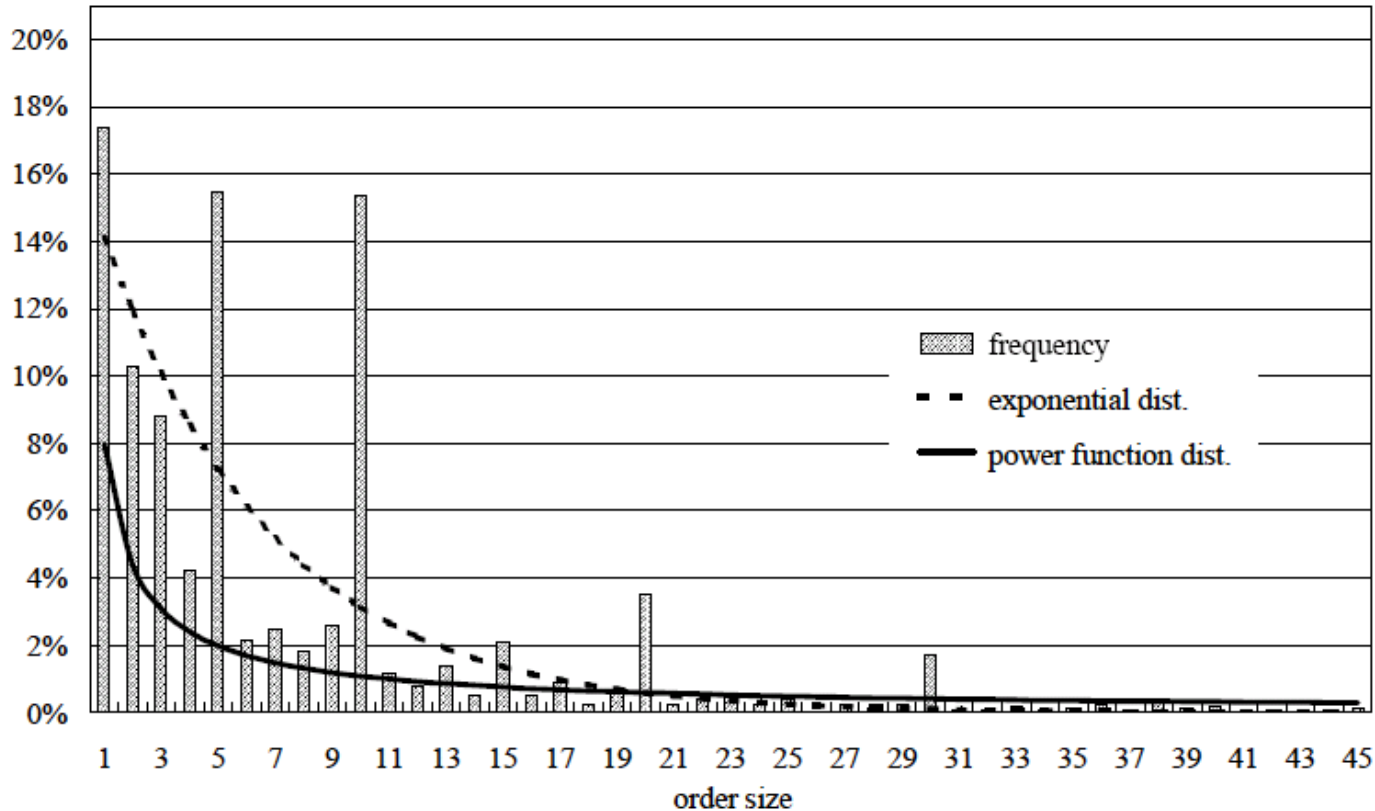


Background

- In JGB futures market, which is an order driven type market treated at the Tokyo Stock Exchange, the frequency of the order quantity follows **an exponential distribution**.
- In artificial market, the frequency of the order quantity usually follows **an uniform distribution**.
- There are little strategy according to the **trading value**, though there are many strategies according to the **trading price**.



The frequency of the order quantity in JGB futures market of Tokyo Stock Exchange



Fukushima Y(2001). "The way of order matchings and price change in the JGB futures market." The Agency of Money Market, Working Paper Series, 2001-J-1



Contents

- The aim and the background
- Introduction of U-Mart
- The method of the experiments
- The results of the experiments



Introduction of U-Mart

- U-Mart is made by U-Mart Project
- U-Mart is an artificial futures market with an underlying asset J30
- Artificial market in which both machine and human agents are allowed to coexist, and a set of tools of it



Contents

- The aim and the background
- Introduction of U-Mart
- The method of the experiments
- The results of the experiments



Experimental Condition (1)

- We used U-Mart for the test bed
- We used the standard agent set as follows.

Agent Name	Number
S-RAND	15
F-RAND	5
TREND	10
ANTI-T	10
S-RSI	15
F-RSI	5
S-MA	15
F-MA	5
SF-SPR	10
DAY-BS	10
Total	100



Experimental Condition (2)

- Market Condition
 - We followed the condition of U-Mart International Experiment 2004 (UMIE2004)
 - 60 days
 - 4 boards per a day
 - Initial endowment 1,000,000,000 JPY
- We run computer simulations 50 times for each experimental conditions



Independent variables

Decision Maker (DM)	(1) TA itself	(2) Meta TA
Order Distribution (OD)	(1) Exponential (3) Normal	(2) Uniform (4) Constant
Average [σ]	(1) 10 [20] (3) 30 [210]	(2) 20 [90] (4) 50 [600]
Time series of Spot Price Information (PI)	(1) Up (3) Bound	(2) Down (4) Oscillation



Independent variables

Decision Maker (DM)

- DM = trading agent (TA) itself
 - Each trading agent determines the trading value according to the certain order distribution (OD)
- DM = meta TA
 - Meta agent decides each trading value of each order according to the certain OD.



Independent variables Order Distribution (OD)

- Probability distribution of order quantity
 - Exponential distribution
 - Uniform distribution
 - Normal distribution
 - Constant



Independent variables

Average and deviation

- There are four kind of average of the distribution as follows

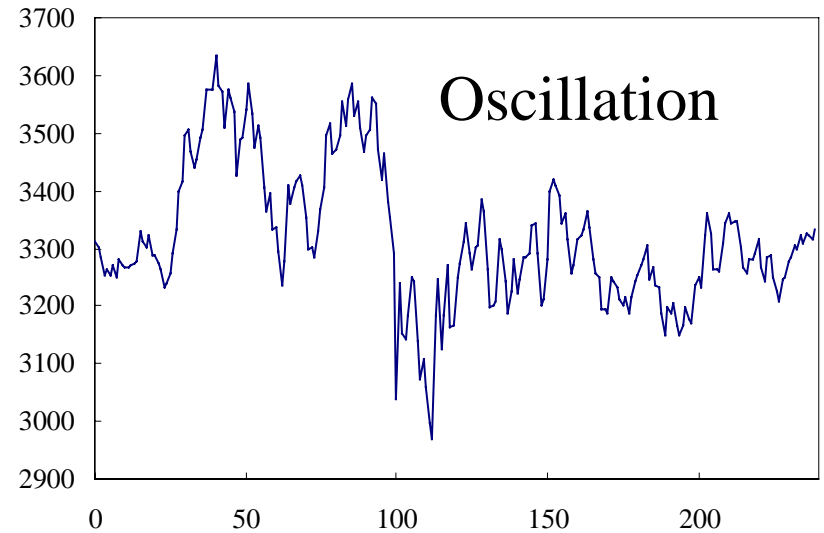
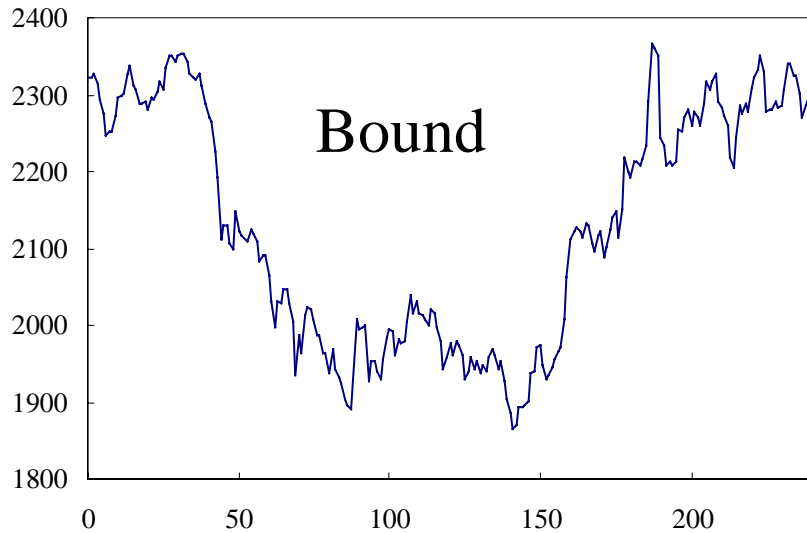
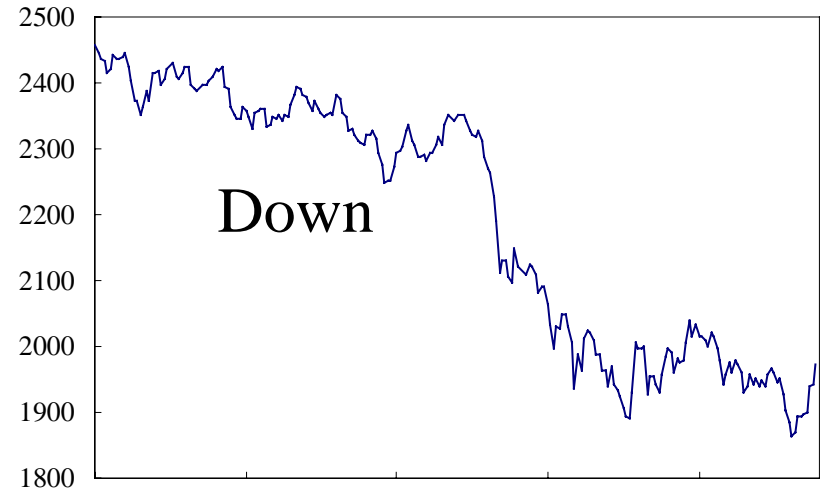
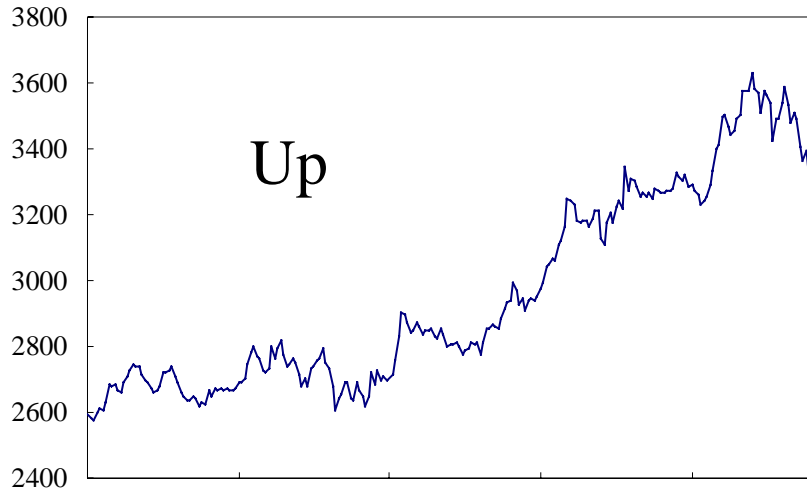
10.20.30.50

- The deviations are same for all OD



Independent variables

Price information (PI)





Dependent variables rate of investment returns (RI).

- Rate of investment returns (RI)
 - Trading agent i 's initial endowment. ω_0
 - The money that i has at the final round T . ω_T

$$\text{Trading agent } i\text{'s } RI_i = \frac{\omega_T - \omega_0}{\omega_0}$$



Dependent variables

Contact Rate (CR)

- Contact Rate (CR)
 - The number of orders made at the Day t . N_t
 - The number of order quantity contracted at the day t . C_t

$$\text{Day } t\text{'s Contact Rate } CR_t = \frac{C_t}{N_t}$$



Contents

- The aim and the background
- Introduction of U-Mart
- The method of the experiments
- The results of the experiments



The result of the rate of investment return (IR)

- Under the $DM = TA$ case

PI		IR Ave.	σ	m	OD
Up	Max.	0.9919	(0.0186)	50	Constant
	Min.	0.9905	(0.0065)	10	Constant
Down	Max.	0.9911	(0.0077)	50	Constant
	Min.	0.9903	(0.0034)	10	Uniform
Bound	Max.	0.9916	(0.0088)	50	Uniform
	Min.	0.9899	(0.0021)	10	Normal
Oscillate	Max.	0.9899	(0.0023)	10	Uniform
	Min.	0.9897	(0.0044)	50	Constant

IR is maximized under the condition that $OD = \text{Constant}$ and the average order value is 50.



The result of the rate of investment return (IR)

- Under the DM = meta case

PI		IR Ave.	σ	m	OD
Up	Max.	0.9919	(0.0186)	50	Constant
	Min.	0.9905	(0.0065)	10	Constant
Down	Max.	0.9911	(0.0077)	50	Constant
	Min.	0.9903	(0.0031)	10	Uniform
Bound	Max.	0.9910	(0.0088)	50	Constant
	Min.	0.9900	(0.0021)	10	Normal
Oscillate	Max.	0.9899	(0.0024)	10	Uniform
	Min.	0.9897	(0.0044)	50	Constant

IR is maximized under the condition that OD = constant and the average of order value is 50



The results of Contract Rate (CR)

- Under the DM = TA case

PI		CR Ave.	σ	m	OD
Up	Max	0.4135	(0.0002)	10	Uniform
	Min.	0.3827	(0.0005)	50	Normal
Down	Max	0.4114	(0.0001)	10	Normal
	Min.	0.3789	(0.0007)	50	Expo.
Bound	Max	0.4112	(0.0002)	10	Constant
	Min.	0.3798	(0.0006)	50	Expo.
Oscillate	Max	0.4110	(0.0002)	10	Expo.
	Min.	0.3783	(0.0004)	50	Normal

CR is maximized under the condition that the average amount of order value is 10.



The results of Contract Rate (CR)

- Under the DM = meta case

PI		CR Ave.	σ	m	OD
Up	Max.	0.4130	(0.0005)	10	Exp.
	Min.	0.3858	(0.0008)	50	Uniform
Down	Max.	0.4139	(0.0004)	10	Exp.
	Min.	0.3740	(0.0007)	50	Uniform
Bound	Max.	0.4228	(0.0006)	10	Normal
	Min.	0.3830	(0.0007)	50	Normal
Oscillate	Max.	0.4131	(0.0005)	10	Uniform
	Min.	0.3815	(0.0010)	50	Exp.

CR is maximized under the condition that the average amount of order value is 10.



Conclusion

- We analysed how the amount of order distribution effects the result of trading.
- High Rate of Investment return (RI) is realized under the condition that constant order is made and the average order value is many.
- High Contact Rate (CR) is realized under the condition that the average order value is small.