Modeling Deposit-Withdrawal Behavior with Risk Tolerance

Toshihiko Takemura
Kansai University

Takashi Kozu
Ricoh Institute of Sustainability and Business

Tetsuro Kobayashi
National Institute of Informatics

In this study, we model and analyze individual's withdrawal behavior with risk tolerance. Consequently, it is found the followings: 1) effects of psychological factors such as degree of trust in information sources and degree of risk aversion are not uniformly against individual's deposit-withdrawal behavior, 2) the probability that they carelessly withdraw their deposits tends to be lower if individuals correctly understand Japanese deposit insurance scheme, and 3) annual income affects individual's deposit-withdrawal behavior, but total amount of his/her deposit and the number of accounting do not affect it. From these findings, we propose that the government and financial institutes implement the measure which promotes to let understand Japanese deposit insurance scheme to depositors.

INTRODUCTION

The Research Institute for Socionetwork Strategies (RISS), Kansai University, Japan has one project with regard to Japanese depositor's behavior, and we investigated factors affecting to the behavior (Yada et al., 2008, 2009, 2010; Takemura and Kozu, 2009, 2010; Takemura, et al., 2011). These studies provide the information for financial institutions' quick response to the contingency situation such as bank run and discuss the efficiency of Japanese deposit insurance scheme.

We have some theoretical studies on bank run (See Gorton and Winton, 2002). Diamond and Dybvig (1983) is the very famous and one of pioneering studies. They approach to the depositors' behaviors from game theory and then show multiple equilibria; one equilibrium is the situation that depositors' coordination is success, and the other is the situation that their coordination is failure. Then, it is silent which equilibrium is selected. This kind of study provides the useful method to know and clarify the mechanism of bank run, but cannot provide us what the measure we should implement is and the impact of the measures.

On the other hand, we have empirical studies on bank run or finance crisis approaching from econometrics and micro econometrics. Their topics are tightening of regulations, the soundness of financial institutions, and the effectiveness of financial policies. Their targets are financial institutions, government and central bank. Therefore, it is not necessarily the case that depositors' behaviors are incorporated in their economic modeling. The reason is simple. The financial reports or IR reports of

financial institutions are disclosed publicly, but it is difficult to gain the micro data of depositors.

In U.S.A., Kelly and Ó Grada (2000) and Ó Grada and White (2001) are valuable empirical studies on bank run. They gained micro data with regard to depositors of when bank runs occurred twice in 1850s, and analyze the data. They clarify that the length of opening of their accounts and hometown impact to their deposit-withdrawal behaviors by running logistic regression analysis, and show the panic process of the social contagion by using classification tree.

Japan experience some bank runs in the past. However, as far as we know, in Japan we have no empirical studies such as Kelly and Ó Grada (2000). As soon as not, with a crow's nest view of some case studies on bank run in Japan, many of studies provide various lessons (Nagaoka and Takemura, 2009). Besides, there are few empirical studies because we had a barrier of collecting micro data of depositors.

For overcoming the barrier, RISS regularly conduct the Internet survey on depositor's behavior in Japan and build the database. This challenging quantitatively enables to analyze the mechanism of bank run. For example, Yada et al (2008, 2009) clarify that by using data mining technique, deposit-withdrawal behavior are impacted to by factors such as understanding of the Japanese deposit insurance scheme, living area and the degree of trust in information source. In addition, they would estimate the total amount of depositors prepared at each branch if bank run occurred. Takemura and Kozu (2009) clarify that by running stepwise logistic regression analysis, factors such as understanding of the Japanese deposit insurance scheme, the degree of trust in information source and the frequency of accessing the source impact to the withdrawal behavior. Besides, it is found that understanding the Japanese deposit insurance scheme can avoid the inadvertent deposit-withdrawal behavior even if depositors receive any information, and that degree of trust in information sources or frequency of accessing the sources does not uniformly affect withdrawal behavior and by features of the degree or the frequency the effects are different even if information source is the same.

In this study, we attempt to model behavior of individual who tends to withdraw her deposit at first after receiving a kind of information with regard to financial turmoil. This behavioral modeling provides richer results and information than Takemura and Kozu (2010) and Takemura, Kozu and Kobayashi (2011). In addition, we conduct simple and straightforward simulation.

FRAMEWORK

Behavioral Modeling

For example, suppose that an individual receives the information which the probability that her financial institute fails is 5%. Then, one individual would judge not to need to withdraw her deposit if the probability is just 5%, the other would judge to withdraw her deposit as soon as possible. Besides, an individual would judge not to withdraw his deposit if the probability is 1%, but he would judge to withdraw his deposit if the probability is 5%. Takemura and Kozu (2010) and Takemura, Kozu and Kobayashi (2011) cannot model this kind of deposit-withdrawal behavior well. In their modeling, population which consists of individuals who tend to withdraw their deposits given the probability of failure of bank is 5% logically includes individuals who tend to withdraw their deposits given the probability is 1%. In this study, in accord with this point, we model decision-making of whether or not individual who tends to withdraw her deposit at first after receiving a kind of information with regard to financial turmoil, not decision-making of whether or not individual withdraw his deposit after receiving the information with regard to financial turmoil. In other words, in this model the probability of failure of bank that depositor can perceive is able to be regarded as a kind of risk tolerance.

For the simplification of modeling, we assume that individual have three alternatives; 1: withdrawing at low-level of the probability, 2: withdrawing at middle-level of the probability, and 3: withdrawing at high-level of the probability. It is interpreted that individual who selects alternative 1 may tend to run a bank, and that individual who selects alternative 3 may tend not to run a bank. These alternatives are mutually exclusive and are regarded as ordered alternatives from the perspective of risk tolerance.

We analyze Japanese depositors' behaviors about these alternatives by running stepwise ordered logit analysis. Any stepwise procedure for selection or deletion of variables from a model is based on a

statistical algorithm that checks for the importance of variables and either includes or excludes them on the basis of a fixed decision rule. Employing a stepwise selection procedure can provide a fast and effective means to screen a large number of variables and to fit a number of logistic regression equations simultaneously. In this study, especially, we use backward selection procedure. Backward selection is to fit the full model on all explanatory variables at first step and remove the least-significant term and re-estimate while it is insignificant (Hosmer and Lemeshow, 2000).

Design of Survey and Data Set

Design of Survey

At recent years, we can often see results of the Internet surveys in reports of some Japanese public offices. The Japan Institute for Labor Policy and Training (2005) and Ishida et al. (2009) discuss the pros and cons of usage of micro data from the Internet survey. Though, we cannot obtain the clear conclusion still now. At the current moment, though statistical problem on representativeness of data remains, compared with classical social survey we point out the following characteristics:

1) It is able to obtain the desired sample size for statistical analysis.
2) Imposing conditions on attributes of respondents beforehand has a prediction for Bayesian approach.
3) Because the Internet survey agilely is conducted, it is easy to collect data set for analysis.

Therefore, we interpret and analyze data from population of Japanese registered with the Internet survey company. Of course, we must discuss the accuracy of the survey. In near future, we will need to expand the scope of the utilization of the data from the Internet survey.

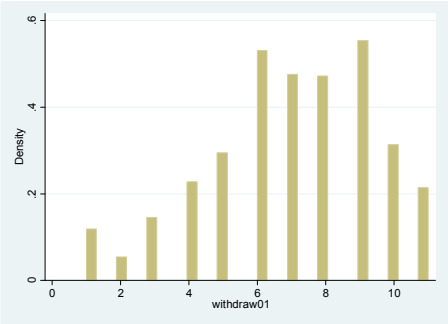
We use data collected from the Internet survey "the survey on depositors' behavior in Japan" conducted in March, 2010. The subjects of this survey are Japanese depositors who have more than one bank account, are more than 20 years old. Because bias of respondents occurs by day and time zone that survey is conducted, samples of this survey are arranged according to three dimensions; gender, age and living area in Japan. To arrange three dimensions, we use the data on the number of population by age group and prefecture divisions in "the number of population and household movements based on basic resident registration on the 31st, March, 2008" which the Ministry of Internal Affairs and Communications in Japanese provides.

The aim of this survey is to capture individual deposit withdrawal behavior from the viewpoints of economics and psychology. This survey asks more than 50 question items such as gender, annual income, degree of risk aversion, the number of friends and so on. This survey includes 3,096 respondents. Note that you can see this survey slip at RISS's Website (URL: http://www.kansai-u.ac.jp/riss /en/shareduse/ database.html).

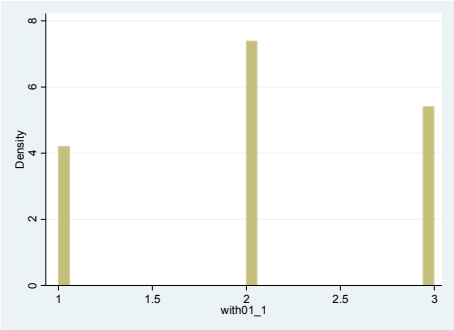
Data Set

In this survey, we ask about the event that an individual withdraw his entire deposit after receiving information on the probability of failure of his bank, k% (for k=0.1, 0.5, 1, 2, 5, 10, 20, 30, 50, 99). See Figure 1-(a). From this questionnaire, we can make three alternatives as explained variable; 1: withdrawing at low-level of the probability, 2: withdrawing at middle-level of the probability, and 3: withdrawing at high-level of the probability. In this study, the low-level of the probability is less than 5%, the middle-level of the probability is 5-30% and the high-level of the probability is over 30%. Each level corresponds to alternative 1-3 (See Figure 1-(b)). Note that alternative 3 includes the case that individual would not withdraw his deposit even if the probability of failure of bank is 99%.

FIGURE 1
DISTRIBUTION OF DEPOSIT-WITHDRAWAL BEHAVIOR



(a)



(b)

Table 1 show a list of explanatory variables. We select these variables based on variables used in Takemura and Kozu (2010) and add some variables such as anxiety and occupation. In addition, we use multiple degrees of risk aversion and time discount rates. Variables regarding with Living area, education and occupation is dummy variables.

In similar to Takemura, Kozu and Kobayashi (2011), we use the degree of trust in the information sources for bad news and the frequency of accessing the sources as explanatory variables.

In the Japanese deposit insurance scheme, under some conditions, up to 10 million yen of insurance per one depositor would be paid. Thus, the purpose of the scheme is avoiding bank run at any risk. Actually, in some pervious literatures, it is found that understanding the scheme is useful and effective. Figure 2 shows understanding of the Japanese deposit insurance scheme.

From the result of the survey, 51.9% of respondents answered that they know the scheme, but do not consider it in their actions. This result has the same tendency with the result of 3rd consumer survey on finance, which the central council for financial services information conducted (URL: http://www.shiruporuto.jp/finance/chosa/enqu2008/index.html). It is noted that this study does not regard these answers as understanding the scheme and the respondents are included in no understanding in Figure 2.

In similar to Takemura, Kozu and Kobayashi (2011), we use the degree of trust in the information sources for bad news and the frequency of accessing the sources as explanatory variables.

In the Japanese deposit insurance scheme, under some conditions, up to 10 million yen of insurance per one depositor would be paid. Thus, the purpose of the scheme is avoiding bank run at any risk. Actually, in some pervious literatures, it is found that understanding the scheme is useful and effective. Figure 2 shows understanding of the Japanese deposit insurance scheme.

From the result of the survey, 51.9% of respondents answered that they know the scheme, but do not consider it in their actions. This result has the same tendency with the result of 3rd consumer survey on finance, which the central council for financial services information conducted (URL: http://www.shiruporuto.jp/finance/chosa/enqu2008/index.html). It is noted that this study does not regard these answers as understanding the scheme and the respondents are included in no understanding in Figure 2.

TABLE 1
A LIST OF EXPLANATORY VARIABLES

	Contents	Items
Gender	Gender	0: Male: 1: Female
Age	Age	Age
It_i	Degree of trust in the information source	How do you trust the following information sources? 1) TV news program 2) TV wide show program 3) Newspaper 4) The Internet excluding 2-channel 5) 2-channel 6) Conversation with neighbors 7) Conversation with people at workplace 8) E-mail or phone call with friends 9) Radio program 10) Weekly/monthly magazines 11) Conversation of strangers 1: I never trust it, 2: I do not trust it at all, 3: I am indifferent of trusting it, 4: I weakly trust it, 5: I strongly trust it
Ia_i	Frequency of accessing the information source	How often do you access the above information sources? 1: Few 2: 1-2 days/week 3: 3-4 days/week 4: 5-6 days/ week 5: Every day
Ujps	Understanding of Japanese deposit insurance scheme	Do you understand the Japanese deposit insurance scheme? 0: No, 1: Yes
E_mass	Effects from mass media	Do you withdraw your deposit when you receive the information regard with financial turmoil from mass media? 1: I never think so 2: I do not think so 3: I am indifferent of thinking so 4: I think so 5: I strongly think so
Ra_i	Degree of risk aversion	1: Pricing the lottery (1%) of 100,000 yen 2: Pricing the insurance to theft (1%) of 100,000 yen
Tp_i	Time discount rate	Compared receiving 10,000 yen now is indifferent with receiving some amount of money after 1 week 1: interest 0% 2: interest 2% 3: interest 6% 4: interest 10% 5: interest 20%
Gt	Degree of trust in government:	Even if main bank fails, I believe that government grantees my deposit. 1: I strictly believe 2: I weakly believe 3: I am indifferent of believing 4: I do not believe 5: I never believe
Exp_eg	Expected economic growth rate	How are your expected economic growth rate in the future 10 years?
Exp_pr	Expected inflation rate	Expected inflation rate in the future 10 years
Income	Annual income (yen)	1: under 0.5 million 2: 0.5-1 million 3: 1-2 million 4: 2-3 million 5: 3-5 million 6: 5-7 million 7: 7-10 million 8: 10-15 million 9: over 15 million
Deposit	The amount of deposit (yen)	1: 0-0.1 million 2: 0.1-0.5 million 3: 0.5-1 million 4: 1-2 million 5: 2-3 million 6: 3-5 million 7: 5-7 million 8: 7-10 million 9: 10-15 million 10: over 15 million
Debt	The amount of debt (yen)	1: 0 2: 0-0.5 million 3: 0.5-1 million 4: 1-2 million 5: 2-3 million 6: 3-5 million 7: 5-7 million 8: 7-10 million 9: 10-15 million 10: 15-30 million 11: over 30 million
Account	# of account	The number of bank account
Unsat_i	Degree of anxiety	Items of anxiety 1) Living are 2) Work 3) Own future 4) Future of Japan 5) Japanese economic condition 6) Home life 7) Financial situation of family 8) Relationships with friends 9) Condition of health 1: I never feel anxiety 2: I do not feel anxiety 3: I do not almost feel anxiety 4: I am indifferent of feeling anxiety 5: I feel kind of anxiety 6: I feel anxiety 7: I strictly feel anxiety
Friend_i	Effects from friends	1: The rate of friends or colleagues bandying about failure of bank 2: The rate of friends or colleagues withdrawing their deposits
D_area_i	Living area	1: Hokkaido-Tohoku area 2: Kanto area excluding Tokyo 3: Tokyo area 4: Hokuriku area 5: Tokai area 6: Kinki area 7: Chugoku area 8: Shikoku area 9: Kyushu area
D_edu_i	Education	Education: 1: Elementary / middle school 2: High school 3: Junior college 4: University and graduate school.
D_work_i	Occupation	1: Regular employer 2: Irregular employer 3: Self-employed individual / company executive 4: Housewife / househusband / student 5: Others including unemployed persons

*: We omit D_area_7, D_edu_3, D_work_2 from our analysis

FIGURE 2
UNDERSTANDING OF THE JAPANESE DEPOSIT INSURANCE SCHEME

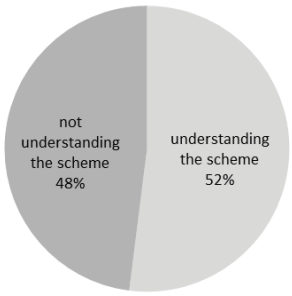
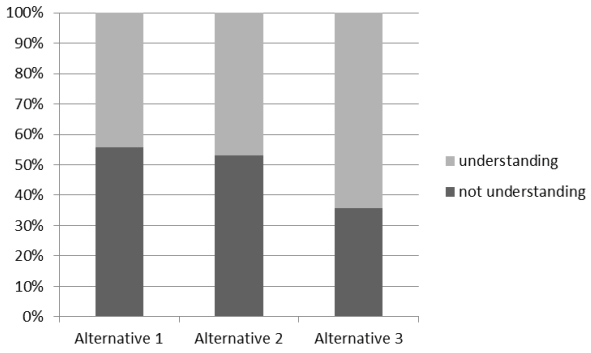


FIGURE 3
RELATION BETWEEN DEPOSIT-WITHDRAWAL BEHAVIOR AND THE UNDERSTANDING OF THE SCHEME



Besides, Figure 3 shows elation between deposit-withdrawal behavior and the understanding of the scheme. We can know that about 64% of respondents who tend to withdraw their deposits at the high-level of the probability understand the Japanese deposit insurance scheme. On the other hand, in the other cases the ratio of respondents understanding the scheme is around 45%.

Under the scheme, total amount of deposit which about 91.5% of respondents are protected (See Figure 4). So, almost respondents need not to withdraw their deposits even if the financial institute failed. However, as you seen in Figure 2, respondents tend to withdraw their deposits after receiving some probabilities of failure of bank. In addition, Figure 5 shows the distribution of annual income and we find about 88.4% of respondents' annual incomes are less than 7 million yen.

We use two kinds of degrees of risk aversion and three kinds of time discount rates in this study. These variables are calculated by some questionnaires in the survey. About details of the method, refer to Ohtake and Tsutsui (2004). In addition, we use nine kinds of degrees of anxiety in Ohtake, Shiraishi and Tsutsui (2010) as explanatory variables.

In history, Japan had experiments that bank runs occurred by the rumor among persons although their management was healthy (Toyokawa Shinkin in 1973 and Saga bank in 2003). These cases may imply that human network or social contagion impact to the deposit-withdrawal behavior. As mentioned above, Kelly and Ó Granda (2000) clarify the panic process of social contagion.

FIGURE 4
DISTRIBUTION OF AMOUNT OF DEPOSIT

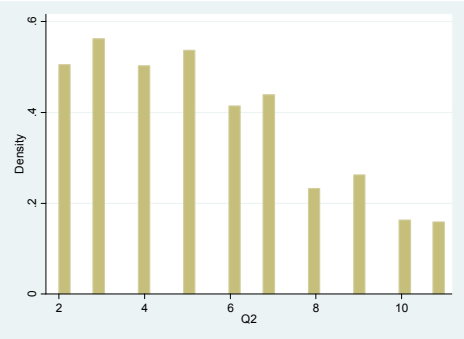


FIGURE 5
DISTRIBUTION OF ANNUAL INCOME

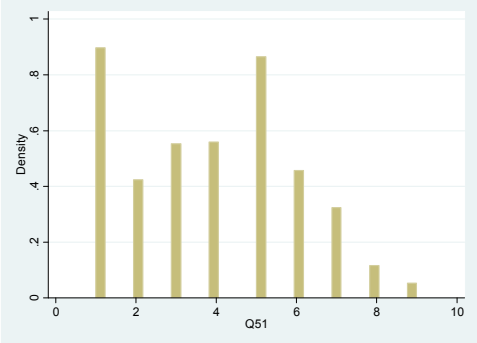


TABLE 2
THE DESCRIPTIVE STATISTICS WITH REGARDING TO THE FRIENDS AFFECTING THE BEHAVIOR

	Mean	Std.Dev.	Min	Max
# of friends	11.681	35.646	1	1510
the rate of friends or colleagues bandying about failure of bank	0.360	0.364	0.0	1.0
the rate of friends or colleagues withdrawing their deposits	0.338	0.351	0.0	1.0

In "the survey on depositors' behavior in Japan", we ask about the number of friends or colleagues bandying about failure of bank and the number of friends or colleagues withdrawing their deposits (affecting their behaviors) in addition to the number of friends or colleagues (The survey has 316 respondents who answer to not interact with another person. In this study, we omit them from the data for analysis). Table 2 shows the statistics regarding with the number of friends, rates of friends or colleagues bandying about failure of bank and withdrawing their deposits.

RESULTS

First of all, we need to set criteria (p-value) of removing insignificant variables in stepwise ordered logit model (Hosmer and Lemeshow, 2000). In this study, we set p=0.10 as criteria. Table 3 shows the

estimated result. First, we enter 64 explanatory variables in Table 1, and the number of variables that are not removed is eventually 17. In this study, Stata 11/SE is used as statistical analysis software.

TABLE 3
ESTIMATED RESULT

	Coef.	Robust Std. Err.	z	p>|z|
b_Gender	0.168	0.090	1.86	0.063
b_Age	-0.008	0.003	-3.03	0.002
b_It_3	0.141	0.048	2.92	0.004
b_It_7	0.106	0.063	1.69	0.092
b_It_8	-0.243	0.063	-3.84	0.000
b_It_11	-0.097	0.054	-1.78	0.076
b_Ia_1	0.106	0.037	2.84	0.005
b_Ia_4	0.045	0.026	1.71	0.087
b_Ia_5	-0.067	0.038	-1.75	0.08
b_Ujps	0.470	0.078	6.02	0.000
b_E_mass	-0.992	0.048	-20.51	0.000
b_Ra_1	8457.994	4604.769	1.84	0.066
b_Gt	0.209	0.036	5.73	0.000
b_Exp_eg	0.013	0.005	2.52	0.012
b_Income	-0.055	0.021	-2.56	0.011
b_Unsat_7	-0.082	0.038	-2.13	0.033
b_Friend_2	0.220	0.109	2.03	0.043
/cut1	-4.291	0.354		
/cut2	-2.011	0.345		
Number of obs =2780 Log pseudolikelihood = -2610.4757 Wald chi2 (17) = 640.57 Pr > chi2=0.0000 Pseudo R2 = 0.1240				

The positive distinction rate in this model turns out to be about 54 %. 1st cut-off point and 2nd cut-off point are -4.29 and -2.01, respectively. If sum of potential variable (coefficient X sum of explanatory variables) and errors is less than value of 1st cut-off point, individual would tend to withdraw the deposit at the low-level of the probability. If the value is in between the 1st cut-off and 2nd cut-off point, individual would tend to withdraw the deposit at the middle-level of the probability. Otherwise, individual would tend to withdraw the deposit at the high-level of the probability.

First of all, we find that male tends to withdraw his deposit rather than female. Besides, the elder individual tends to withdraw his deposit.

Next, the higher degree of trust in the information sources such as newspaper and conversation with people at workplace are, the less individuals tend to withdraw his deposit. Conversely, the higher degree of trust in the information sources such as e-mail or phone call with friends and conversation of strangers are, the more they tend to withdraw their deposits. On the other hand, the estimated parameters of the frequency of accessing the information sources such as TV news program, the Internet and 2-channel is significant at 10% level. The more frequent individuals access TV news program and the Internet excluding 2-channel, the less they tend to withdraw his deposit. But, the more frequent they access 2-channel, the more they tend to withdraw their deposits. This implies that effects of degree of trust in some information sources are not uniformly against individual's deposit-withdrawal behavior and that the effects differed by a kind of the information source.

It is found that understanding the Japanese deposit insurance scheme is useful and effective to avoid the bank run (Similar to Takemura, Kozu and Kobayashi (2011), we run stepwise logistic analysis at each probability of failure of bank. As the result, we confirm that understanding the Japanese deposit insurance scheme is useful and effective to avoid the bank run). Though, as mentioned above, ratio of individuals

who do not correctly understand the Japanese deposit insurance scheme is around 48% at the present. Since this ratio is not high, still now, we should reduce the ratio.

From the sign of effects from mass media, b_E_mass, we find effects from mass media contribute to the deposit-withdrawal behavior irrespective of kinds of media. This conjures images that the mass media have clout after all.

The sign of estimated parameters of the degrees of risk aversion, the degree of trust in the government and expected economic growth rate are positive. On the contrary, the sign of estimated parameters of annual income and degree of anxiety on financial situation of family are negative. This is, the more risk-averse individuals are, the less individuals tend to withdraw his deposit. In the same manner, the more individuals trust in the government or the higher they expect the future economic growth rate, the less individuals tend to withdraw his deposit. We find that economic situation and trust in the system impact to the deposit-withdrawal behavior. Conversely, the higher they feel anxiety on financial situation of family or the higher their annual incomes are, the more they tend to withdraw their deposits.

Furthermore, the amount of deposit and/or the number of account that often used as economic factors are removed in the process of stepwise ordered logit analysis. Therefore, these variables do not impact to the deposit-withdrawal behavior. In other words, bank run could occur irrespective of having multiple accounts as the purpose for diversification of risk and the scope of the Japanese deposit insurance scheme.

Finally, as the variables on the effects from friends, the sign of estimated parameter of the rate of friends or colleagues withdrawing their deposits is positive. That is, the higher the rate is, the less they tend to withdraw their deposits. However, the sign of estimated parameter is different from our assumption (we assume the parameter is positive). So, the result somewhat sounds odd. In near future, we will conduct additional analysis the details of this result.

SIMULATION

We can easily calculate the probability of individual withdrawing the deposit by using estimated parameters in Table 3 and micro data in the survey. For example, we show an example of the calculation in Table 4 (When we calculate the probability, we use mean of each variable about the other explanatory variables. See Table 5). In this table, we show the probability of when individuals understand the Japanese deposit insurance scheme and the probability of when individuals do not understand the Japanese deposit insurance scheme. From Table 4, by understanding the scheme, ratio of individuals withdrawing their deposits at the low-level of the probability enable to decrease about 0.075 point.

Similar to this study, the financial institute can calculate the probability of individual withdrawing the deposit by using estimated parameters in Table 3. Though, it may be difficult to collect micro data on all explanatory variables by themselves via their original survey. Except, they grasp explanatory variables such as sex, age and annual as customer information. So, they can calculate the probability based on the information that they grasp and estimated parameters in Table 3. Table 5 is a list of the mean of explanatory variables.

Similar to Yada et al (2008, 2009), we can estimate the total amount of deposits prepared in a branch. This provides the important information regarding with risk management. The total amount of deposits prepared in a branch is calculated by the following equation.

$$D^j = \sum_{i=1}^{n} \left(\sum_{l=1}^{j} p_i^l \right) d_j \qquad (*)$$

TABLE 4
UNDERSTANDING THE SCHEME AND RATIO OF WITHDRAWING THE DEPOSIT

	Understanding the scheme	Not understanding the scheme
1: withdrawing at low-level of the probability	0.2413	0.1659
2: withdrawing at middle-level of the probability	0.5154	0.4945
3: withdrawing at high-level of the probability	0.2433	0.3396

TABLE 5
MEAN OF EXPLANATORY VARIABLES

	Sex	Age	It_3	It_7	It_8	It_11
Mean	0.49280576	48.944604	2.7208633	3.0823741	3.2115108	2.3410072
	Ia_1	Ia_4	Ia_5	Ujps	E_mass	Ra_1
Mean	4.2834532	3.5920863	1.502518	0.51870504	3.6751799	0.00001395
	Gt	Exp_eg	Income	Unsat_7	Friend_2	
Mean	3.2125899	-0.3123777	3.8363309	3.8568345	0.33791976	

TABLE 6
UNDERSTANDING THE SCHEME AND RATIO OF WITHDRAWING THE DEPOSIT

Condition		Ratio
Male: 25 y/o and annual income is 4.5 million yen	1: withdrawing at low-level of the probability 2: withdrawing at middle-level of the probability 3: withdrawing at high-level of the probability	0.1925 0.5073 0.3002
Male: 55 y/o and annual income is 6 million yen	1: withdrawing at low-level of the probability 2: withdrawing at middle-level of the probability 3: withdrawing at high-level of the probability	0.2423 0.5154 0.2423
Female: 28 y/o and annual income is 5 million yen	1: withdrawing at low-level of the probability 2: withdrawing at middle-level of the probability 3: withdrawing at high-level of the probability	0.1789 0.5017 0.3194
Female: 32 y/o and annual income is 0.8 million yen	1: withdrawing at low-level of the probability 2: withdrawing at middle-level of the probability 3: withdrawing at high-level of the probability	0.1530 0.4855 0.3615

where D^j is the total amount of deposits prepared in a branch at probability j, p_i^j is the probability of withdrawing the deposit, d_i is amount of individual's deposit. Besides, a branch has n depositors. Note that p_i^j is calculated by using Table 3 and Table 5.

Here, we show four examples of ratio of withdrawing the deposit in Table 6. In this manner, according to equation (*), the financial institute can calculate the total amount of deposits prepared in a branch by using explanatory variables such as sex, age and annual and the mean of the others in Table 5.

POLICY IMPLICATION AND THE FUTURE WORKS

In this study, we model individual's withdrawal behavior with risk tolerance. By analyzing our model, it is found the followings: 1) effects of psychological factors such as degree of trust in information sources and degree of risk aversion are not uniformly against individual's deposit-withdrawal behavior. 2) the probability that they carelessly withdraw their deposits tends to be lower if individuals correctly understand Japanese deposit insurance scheme. 3) annual income affects individual's deposit-withdrawal behavior, but total amount of his/her deposit and the number of accounting do not affect it. Especially,

finding 2) may have important implication to the authorities concerned. By understanding the scheme, ratio of individuals withdrawing their deposits at the low-level of the probability enable to decrease about 0.075 point. Therefore, we propose that the government and/or financial institutes implement the measure which promotes to let understand Japanese deposit insurance scheme to depositors. Such measure would determine sustain of confidence and establishment as one of the purposes of the Japanese deposit insurance scheme.

Finally, let us briefly explain future works. Because "the survey on depositors' behavior in Japan" that we use in this study includes geographical information, we may analyze the panic process by the similar method to Kelly and Ó Grada (2000). In addition we would like to improve the model hereafter.

REFERENCES

Diamond, D. & Dybvig, P. (1983). Bank Runs, Deposit Insurance, and Liquidity. *Journal of Political Economy*, 91, 401-419.

Gorton, G. & Winton, A. (2002). Financial Intermediation. *NBER Working Paper Series*, No.8928.

Hosmer, D.W. & Lemeshow, S. (2000). *Applied Logistic Regression (Wiley Series in Probability and Statistics) 2nd edition*, NEW YORK: Wiley-Interscience Publication.

Ishida, H., Sato, K., Sato, H., Toyota, Y., Hagiwara, M., Hagiwara, M., Honda, N., Maeda, Y. & Miwa, T. (2009). Toward Establishing the Trustable Internet Survey. *SSJDA Research Paper Series (The Institute for Social Science, the University of Tokyo)*, SSJDA-42.

Kelley, M. & Gráda, C.Ó. (2000). Market Contagion: Evidence from the Panics of 1854 and 1857. *American Economic Review*, 90, (5), 1110-1124.

Nagaoka, H. & Takemura, T. (2009). Case Studies of Bank Run in Financial Institutions: Suggestion from the Viewpoint of Risk Management. *Selected Proceedings of the 2nd International Conference on Social Science*, 27-42.

Ohtake, F., Shiraishi, Y. & Tsutsui, Y. (2010), *Happiness in Japan: Gaps, Labor and Famil*y, Tokyo: Nippon Hyoronsya.

Ó Gráda, C. & White, E.N. (2001). Who Panics During Panics? Evidence from a Nineteenth Century Savings Bank. *NBER Working Paper Series*, No.8856.

Ohtake, F. & Tsutsui, Y. (2005). Measurement of Risk Aversion: Experiment 2004.3 in Osaka University. http://www2.econ.osaka-u.ac.jp/coe/project/project.html.

Takemura, T. & Kozu, T. (2009). An Empirical Analysis on Individuals' Deposit-withdrawal Behaviors Using Data Collected through a Web-based Survey. *Eurasian Journal of Business and Economics*, 2, (4), 27-41.

Takemura, T. & Kozu, T. (2010). Modeling Individuals' Deposit-withdrawal Behaviors after Receiving Information on Financial Turmoil. *The Research in Business and Economics Journal*, 3.

Takemura, T., Kozu, T. & Kobayashi, T. (2011). The Empirical Study of Japanese Deposit Withdrawal Behaviors on Unstable Financial Environment. *American Journal of Economics and Business Administration,* 3, (2), 288-295.

The Japan Institute for Labor Policy and Training (2005). Can the Internet Survey Be Used for the Social Survey? A Result by Experiment. *Reports on Labor Policy*, No.17.

Yada, K., Washio, T., Ukai, Y. & Nagaoka, H. (2008). A Bank Run Model in Financial Crises. *Proceeding of KES 2008*, LNAI 5178, pp703-710.

Yada, K., Washio, T. & Ukai, Y. (2010). Modeling Deposit Outflow in Financial Crises: Application to Branch Management and Customer Relationship Management. *International Journal of Advanced Intelligence Paradigms*, 2, (2/3), 254 – 270.

Yada, K., Washio, T., Ukai, Y. & Nagaoka, H. (2009). Modeling Bank Runs in Financial Crises. *The Review of Socionetwork Strategies*, 3, (1), 19-31.