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Statistical analysis on individual deposit-withdrawal behaviors: An empirical analysis using individual data collected through a Web-based survey

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Abstract

The purpose of this research is to investigate relationships between individual behaviors of whether depositors will withdraw all of their deposits and factors such as the degree of trust in information sources, frequency of communication, an individual's way of dealing with banks, and individual attributes statistically or quantitatively. We assume that a method whereby depositors will not excessively withdraw their deposits after receiving uncertain information on the financial environment. To this purpose, we analyze the relationships by using individual data collected through a Web-based survey we conducted in 2007. The results were as follows: First, individuals who trust in information sources such as weekly/monthly magazines, the Internet, and rumors from people at the workplace would be more likely to withdraw their deposits. Second, an increase of phone call frequency with friends and frequency of communication at neighborhood and workplaces also leads depositors to withdraw

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funds. Third, when depositors receive uncertain information on the financial environment, their tendency to withdraw their deposit is affected by a difference between individual attributes such as gender and education. The authors suggest that government needs to improve and spread the individual's recognition of the deposit insurance system as a first-step policy for preventing depositors from a panic situation such as a bank run.

KEYWORDS: withdrawing deposit, logistic regression analysis, Web-based survey

1 Introduction

What action do you take if you hear that the financial institution where you keep your money is about to fail? Are you likely to withdraw your deposit from the account, if you can? Are you likely to pass the rumor of bank failure to your friends, colleagues and family even if the rumor is not credible? Actually, there is a run on the banks case exists in Japan because of a non-credible rumor in the past (Nagaoka and Takemura 2008).

Is it necessary for depositors to withdrawal all their money if such a situation occurs? If appropriate countermeasures are not taken, the economy and the market might become unstable, and the panic might spread to other countries through globalization. It is sometimes said that the worldwide financial crisis is caused by a delay of countermeasures and new policies. Banks, financial authorities and governments therefore should discuss appropriate prior and post countermeasures. Especially important is that the countermeasures are based on scientific approaches, not countermeasures based on historical or no-scientific approaches such as rule of thumb. Responding to a crisis rapidly if an unexpected situation occurs is difficult. On the other hand, most academic researchers and economists are strictly interested in financial crises that have occurred recently all over the world, and they research economic situations from various viewpoints. Most macroeconomists believe in clarifying the reasons for financial crises by building a macroeconomic model and suggesting policies based on the model. Of course, it is clear that macroeconomic indexes such as stock prices and the growth rate of the GDP affect the aggregated economy and people's financial behavior. However, it is doubtful that macroeconomics can capture people's behavior in a financial panic situation. In other words, financial policies using macroeconomic models have limited use for sensitive issues such as financial panic.

Therefore, in this article, we challenge to create a model for study decision-making in individuals who withdraw their deposits. We also investigates which factors affect withdrawal behavior. By investigating such factors, we believe that banks, financial authorities and governments can learn prior countermeasures for bank runs, and will learn post countermeasures even if a bank run unfortunately occurs. That is, the authors of this paper believe they can offer countermeasures and policies for the banks, financial authorities and governments that should be considered. For this purpose, we analyze the relationships of depositors by using individual data collected through a Web-based survey we conducted in 2007. This kind of research at the individual level is still now in exploratory stages and the accumulation of data so far has been small.

The reasons for our work are discussed next. Quantitative analyses on bank runs have not yet been done. As mentioned previously, modeling within a framework of macroeconomics is limited because a few ex-post data are only used in this research. Analyses based on modeling through a framework of microeconomics are needed for policy support. As mentioned in Nagaoka and Takemura (2008), decision-making based on a depositor's psychological perspective has not been analyzed much in economic fields because most researchers are interested

in cases caused by the failure of the management of the bank and not individual factors.

This paper is organized as follows. Section 2 introduces previous work on financial crises and bank runs. Next, we present our model, and explain the statistical method and data set in section 3. Section 4 shows estimated results and the implications. Finally, we conclude remarks and point out future work in section 5.

2 Previous Works Review

Research is available from various economic approaches on financial crises.

Almost all research on financial crises studied the effects of policies on financial crises from macroeconomic perspective, for example, Choe and Lee (2003), and Pathan, Skully and Wickramanayake (2008). They verify what kind of long- term financial impact on markets result from polices on bank restructuring during financial crisis. This research provides important suggestions on countermeasures which governments should take in a financial crisis. On the other hand, from a microeconomic perspective, few research on financial crises have yet to be been accumulated. In other words, almost none of the previous quantitative research on financial crises produces models at the individual level. However, there are a few researches, such as Yada, Washio, Ukai and Nagaoka (2008), and Takemura and Ukai (2008) base models at the individual level.

Yada, Washio, Ukai and Nagaoka (2008) models a bank run during a financial crisis. They build a model of an account holder's bank-runs in a financial crisis, and use this model to estimate deposit withdrawal amounts during financial crises by using data-mining as an estimation technique. Their research estimates the total deposit withdrawal amount at a branch when the bank has credit insecurity, and they verify significant differences of estimated total deposit withdrawal amounts caused by differences of branch location and main depositor groups.

Takemura and Ukai (2008) models decision-making on whether or not individuals withdraw their deposits after receiving uncertain information on the financial environment. These authors estimate the parameters of various attributes in the model by using a statistical method. Next, the authors mention the need for a model that includes psychological factors and economic variables that do not affect decision- making on withdrawing a deposit. Our work is based on Takemura and Ukai (2008).

Research based on a microeconomic perspective is richer than research based on a macroeconomic perspective because the former perspective has much information and can capture an individual's (unexpected) behavior. Therefore, in this work, analyses are based on a microeconomic perspective.

Finally, we introduce historical research on financial crises; Nagaoka and Takemura (2008), and Shiller (2008). This research is important when we analyze the financial crises from the viewpoints of economics, too.

3 Framework

3.1 Model/Statistical Method

The purpose of this research is to statistically or quantitatively investigate relationships between individual depositor withdrawal behavior and whether they will withdrawal all of their deposits and factors such as the degree of trust in information sources, frequency of communication, individual relations in dealing with banks, and individual attributes. By doing so, we suggest a method such that depositors do not withdraw their deposits excessively after receiving uncertain information on the financial environment.

For a long time, logistic regression (or multiple logistic regression) has been widely used for building a decision-making model as a statistical method for grasping the relationships among explanatory variables and explained variables in various fields such as psychology, sociology, economics, and business administration. Generally, a logistic regression model consists of an explained variable which is a probability that a certain event happens p, and explanatory variables as co-variables that influence p. Note that p follows logit distribution, $\text{logit}(p) = \log(p/1-p)$.

In this research, we build our model by a logistic regression analysis. In our model, the explained variable is the probability that individuals withdraw all of their deposits after receiving uncertain information on financial environment p, and explanatory variables are divided roughly as follows: 1) degree of trust in information sources X_1, 2) frequency of communication, X_2, 3) individual relations in dealing with banks, X_3, and 4) individual attributes, X_4. Section 3.2 will concretely explain these variables in detail.

The relationship between the explained variable and explanatory variables is simply described by using equation (1).

$$p = \frac{\exp[a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4]}{1 + \exp[a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4]} \tag{1}$$

or,

$$\log(p/1-p) = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 \tag{2}$$

Note that we can obtain equation (2) by taking the logarithm of both sides of the equation (1).

A feature of our model in (2) is incorporating not only economic variables, but also psychological variables in the decision-making of a depositor's behavior. We assume that depositors would be strictly affected by psychological factors if they encounter a financial panic situation such as a bank run.

In general, many economic models using individual data have only various economic variables such as revenue, asset, investment, consumption, and so on. Of course, such an analysis is meaningful, but it does not demonstrate the charm of analysis. We insist that it is important to incorporate psychological factors into economic analyses by using individual data[1]. This individual data

[1]Many macroeconomic models cannot incorporate psychological factors.

is particularly useful when we analyze a panic situation by using an economic framework[2]. In this way, we will be able to build a richer economic behavioral model.

The explained variable on the left side of equation (2) represents a logarithm odds ratio. This can be interpreted as the degree to which individuals are apt to withdraw all of their deposits[3]. Also, the coefficient parameter of each explanatory variable on the right side represents a logarithm odds ratio when the explanatory variable changes one unit. For example, if X_j with the ordinary property changes one unit and the coefficient parameter b_j is positive (resp. negative), then individuals are apt to (resp. not to) withdraw all of their deposits after receiving uncertain information on financial environment. In other words, bank run will occur if many individuals withdraw, and such a situation is a risk for banks.

Here, we introduce methods and processes to estimate coefficient parameters in equation (2), and to evaluate the fitness of our model. To estimate each coefficient parameter in equation (2), we use the general maximum likelihood estimation method based on a binominal distribution. Because calculating the estimation is too complex, we use SPSS as statistical computer software in this work[4]. SPSS has a) a forceful method for inserting explanatory variables, b) a variable increase (decrease) method by likelihood ratio, c) a variable increase (decrease) method by Wald, and d) a conditional variable increase (decrease) method as a method of variable selection. From these methods, we apply the variable increase and decrease methods by likelihood ratio as a method of variable selection in this work. This method is often used as one of preferable indexes among methods[5].

We run the Hosmer-Lemeshow test to evaluate the fitness of our model. Note that the null hypothesis of this test H_0 is that the model is well suited[6]. In addition, we evaluate the validity of the model by using a positive distinction rate, which forecasts this model correctly[7].

In this work, we run both variable decrease methods and variable increase methods by likelihood ratio and compare the methods. Then, we synthetically evaluate estimated results from the viewpoints of fitness and validity.

[2]In other words, it is valid and natural that we assume deposit behavior is not only a result of decision-making with economic rationality under such a situation.

[3]An odds ratio is a statistical measurement showing the odds of an event occurring in one group to the odds of it occurring in another group.

[4]We use SPSS version 17.01J for Windows, SPSS, Inc..

[5]It would be preferable to use a variable stepwise method by likelihood ratio, but unfortunately, SPSS does not have this method.

[6]Refer to Hosmer and Lemeshow (2000) about details of this test.

[7]The higher the positive distinction rate, the more correctly the model is forecasted. Therefore, this model is said to be preferable.

3.2 Dataset

We use data collected through a Web-based survey, which is a questionnaire survey via the Internet[8]. The data collection period was September 8 to 9, 2007. The sample size is 1500. Collected data includes over 70 properties such as gender, age, and education, and attributes related to bank run conduct, such as recognition of deposit insurance, income level, total amount of deposit, and so on. In this paper we use some of these properties.

Compared with other social surveys, pure statisticians and researchers who conduct social surveys point out that a Web-based survey has various biases because the collection method of Web-based surveys is not necessarily random sampling. These statisticians are correct, and overcoming this problem is important. Recently, some researchers have been trying to develop a method and procedure to coordinate such biases[9]. If common methods are established, the problems will be overcome. In this work, we do not especially discuss the problem on bias in the Web-based survey, but we insist that there are trade-off relationships among social surveys[10]. The collection method of the mail survey and telephone survey generally are adopted random sampling, but rate of recovery has decreased rapidly in recent years and cost of the surveys is too expensive[11]. On the other hand, the cost of the Web-based survey is less expensive than the other social surveys, and a lot of samples can be collected in a short period.

We conducted this survey in 2007 and considered the trade-off relationship between the merits of a Web-based survey and problems regarding bias. Note that this survey has some biases on sampling. So, results of this research might not have generality. However, as mentioned section 1, this research has various possibilities in social sciences.

3.2.1 Individual withdrawal behavior on withdrawal of all deposits

Our explained variable is given in equation (2): Whether an individual will withdraw her entire deposit or not, after receiving uncertain information on the financial environment. Other actions are not considered (i.e. withdrawal of part of the deposit). Therefore, in this work, the explained variable in equation (2) is defined as follows:

$$p = \begin{cases} 1 & \text{if she withdraws her deposit} \\ 0 & \text{otherwise} \end{cases}$$

[8]The data we have collected can be used all over the world for research purposes by applying to the Research Institute for Socionetwork Strategies (abbreviation, RISS), Kansai University. Our data, can be accessed through the the Website (http://www.kansai-u.ac.jp/riss/en/shareduse/database.html), or by direct contact.

[9]Refer to Hoshino (2007), for example.

[10]Ohsumi (2002) gives some suggestions on the limit and possibilities of Web-based surveys in the future.

[11]n Japan, conducing social surveys such as mail-in surveys, and phone surveys) are too difficult to conduct because of an act on protecting individual information. Recently, social surveys via the Internet are increasing in Japan. In the near future, Web-based surveys will be the most popular type of survey.

where p represents the probability that she withdraws her deposit.

The frequency distribution for withdrawing all deposits is shown Table 1.

Table 1: Frequency Distribution for Withdrawing all Deposits

	N	%
Withdraw	555	37.0
Do not withdraw	945	63.0
Total	1500	100

3.2.2 Degree of trust in information sources

We assume information sources as TV, newspapers, weekly/monthly magazines, Internet, e-mail, or phone calls with friends, rumors from neighbors, and rumors from people at the workplace.

The features of the information sources are in Table 2, but these features are not strict.

Table 2: Features of Information sources

Information source	Form	Direction	Remarks
1) TV	Formal information	One way	The transmission speed is a little slow
2) Newspapers	Formal information	One way	The transmission speed is a little slow
3) Weekly/Monthly Magazines	Informal information	One way	The transmission speed is slow
4) Internet	Informal information	Interactive	The transmission speed is fast
5) e-mail or phone calls with friends	information	Interactive	The transmission speed is fast
6) rumors from neighbors	information	Interactive	The transmission speed is fast
7) rumors from people at workplace	information	Interactive	The transmission speed is fast

The degree of trust in these information sources X_{1j} (for $j = 1, \cdots, 7$) are measured by the following 5 ordinal indexes: (1) I never trust it, (2) I do not trust them at all, (3) both/either, (4) I weakly trust them, and (5) I strongly trust them[12].

[12]Similarly, Takemura and Ukai (2008) analyze the depositor's behavior including the Yamagishi and Yamagishi measurement as a psychological factor. Refer to Yamagishi and Ya-

Frequency distribution on each degree of trust in information sources is shown in Table 3.

Table 3: Degree of Trust in Information Sources

	(1)		(2)		(3)		(4)		(5)	
	N	%	N	%	N	%	N	%	N	%
1)	122	8.1	805	53.7	367	24.5	177	11.8	29	1.9
2)	231	15.4	902	60.1	268	17.9	80	5.3	19	1.3
3)	5	0.3	172	11.5	592	39.5	624	41.6	107	7.1
4)	24	1.6	445	29.7	731	48.7	270	18.0	30	2.0
5)	83	5.5	518	34.5	700	46.7	179	11.9	20	1.3
6)	7	0.5	128	8.5	641	42.7	574	38.3	150	10.0
7)	13	0.9	241	16.1	796	53.1	381	25.4	69	4.6

Total number of samples: 1500

From Table 3, we can find that many people trust TV and newspapers, but the other sources are not trusted as much.

3.2.3 Frequency of communication

We describe the frequency of communication using the frequency of phone calls and e-mail with friends, and the frequency of communication with neighbors and people at the workplace, respectively. Each frequency of the communication is shown in Table 4 - Table 7.

From these tables, the frequency of communication with people at the workplace was found to be more than two times per one day, which is a lot, but the other frequency is not as much.

The frequency of communication is X_{2m} $(m = 1, \cdots, 4)$: 1) the frequency of phone calls, 2) the frequency of e-mail with friends, 3) the frequency of communication with neighbors, and 4) the frequency of communication with

Table 4: Frequency of Phone Calls

	N	%
(1) one time per month	529	35.3
(2) 2 -3 times per week	507	33.8
(3) 1 -5 times per day, and	376	25.1
(4) more than 6 times per day	88	5.9
Total	1500	100

magishi (1994).

Table 5: Frequency of E-mail with Friends

	N	%
(1) one time per month	436	29.1
(2) 2 -3 times per week	488	32.5
(3) 1 -5 times per day, and	420	28.0
(4) more than 6 times per day	156	10.4
Total	1500	100

Table 6: Frequency of Communication with Neighbors

	N	%
(1) no communication with others	848	56.5
(2) one time per week	245	16.3
(3) one time per 2 - 3 days	200	13.3
(4) one time per day	125	8.3
(5) more than 2 times per day	82	5.5
Total	1500	100

Table 7: Frequency of Communication with People at the Workplace

	N	%
(1) no communication with others	460	30.7
(2) one time per week	68	4.5
(3) one time per 2 - 3 days	114	7.6
(4) one time per day	226	15.1
(5) more than 2 times per day	632	42.1
Total	1500	100

people at the workplace) is measured by the following ordinal indexes: (1) one time per month, (2) 2 - 3 times per week, (3) 1 - 5 times per day, and (4) more than 6 times per day, for the frequency of phone calls and e-mail with friends, and (1) no communication with others, (2) one time per week, (3) one time per 2 - 3 days (4) one time per day, and (5) more than 2 times per day.

3.2.4 The relation of individual people in dealing with banks

To capture the relation of individuals dealing with banks, we use the following values; the number of bank accounts, type of main bank, the total amount of deposits, ratio of term deposit in total amount of deposits, annual income, and recognition of the deposit insurance system.

In a Web-based survey, individuals name their main bank. We define the type of main bank by using the following indicator function:

$$X_{32} = \begin{cases} 1 & \text{if depositor's main bank is a mega bank including Yucho bank} \\ 0 & \text{otherwise} \end{cases}$$

In addition, the recognition of the deposit insurance system is defined as follows:

$$X_{36} = \begin{cases} 1 & \text{if depositor recognizes the deposit insurance system} \\ 0 & \text{otherwise} \end{cases}$$

Table 8 shows elementary statistics on the number of bank accounts and the ratio of term deposit in total amount of deposits.

Table 8: Elementary statistic on the number of bank accounts and the ratio of term deposit in total amount of deposits

	Average	Median	Standard deviation	Kurtosis	Skewness
Number of bank accounts	3.43	3	1.80	7.52	1.70
Ratio of term deposit in total amount of deposits	23.85	10	30.57	3.76	1.39

In addition, Tables 9 - 12 show the frequency of the type of main bank, the total amount of deposits, annual income and recognition of the deposit insurance system.

From each table, the highest frequency of total amount of deposit is less than 5 million yen and annual income is less than 2 million yen, respectively. In Table 12, the rate of people that recognize the deposit insurance system is more than 85%.

Table 9: Frequency of Type of Main Bank

	N	%
Mega banks including Yucho bank	686	45.7
Others	814	54.3
Total	1500	100

Table 10: The Total Amount of Deposits

	N	%
1) less than 5 million yen	1169	77.9
2) 5 - 10 million yen	176	11.7
3) more than 10 million yen	155	10.3
Total	1500	100

Table 11: Annual Income

	N	%
1) less than 2 million yen	564	37.6
2) 2 - 3 million yen	167	11.1
3) 3 - 4 million yen	193	12.9
4) 4 - 5 million yen	167	11.1
5) 5 - 6 million yen	124	8.3
6) 6 - 7 million yen	88	5.9
7) 7 - 8 million yen	58	3.9
8) 8 - 9 million yen	44	2.9
9) more than 10 million yen	53	3.5
Total	1500	100

Table 12: Recognition of Deposit Insurance System

	N	%
Recognition	1279	85.3
No recognition	221	14.7
Total	1500	100

3.2.5 Individual attributes

As individual attributes, we use gender, age, education, living area, married or not, and type of employment.

Tables 13 - 18 show the frequency of each individual attribute, respectively.

Table 13: Gender

	N	%
Male	765	51.0
Female	745	49.0
Total	1500	100

Table 14: Age

	N	%
One's teens	14	0.9
One's twenties	286	19.1
One's thirties	631	42.1
One's forties	366	24.4
One's fifties	121	8.1
More than one's sixties	82	5.5
Total	1500	100

Table 15: Education

	N	%
graduation from Junior high school	32	2.1
graduation from Junior college and high school	560	37.5
graduation from career college	15	1.0
graduation from higher professional school	199	13.3
graduation from university	604	40.4
graduation from Graduate school	85	5.7
Total	1495	100

Note that the other items excluding age and education are treated as category data and education is treated as ordinal data.

Table 16: Living Area

	N	%
Hokkaido and Tohoku area	157	10.5
Kanto area	634	42.3
Hokuriku and Koshinetsu area	77	5.1
Tokai area	138	9.2
Kinki area	310	20.7
Chugoku area	73	4.9
Shikoku area	21	1.4
Kyushu and Okinawa area	90	6.0
Total	1500	100

Table 17: Married or Not

	N	%
Married	854	56.9
Not married	646	43.1
Total	1500	100

Table 18: Type of Employment

	N	%
Self employed	113	7.5
Work in family business	49	3.3
Permanently employed (salaried, etc.)	742	49.5
Temporary or part time	191	12.7
Employee dispatched to other company	69	4.6
Unemployed but seeking work	76	5.1
Not working or seeking work	260	17.3
Total	1500	100

4 Estimated Results and Implications

In this section, we estimate the coefficient parameters in equation (2) by running both a variable decrease method and a variable increase method by likelihood ratio. First, we use 23 kinds of explanatory variables that we introduced in section 3. For the reader's convenience, we show explanatory variables' descriptions in Table 19.

Table 19: Explanatory Variables' Descriptions

Variable name	Description
X_{11}	TV
X_{12}	newspapers
X_{13}	weekly/monthly magazine
X_{14}	Internet
X_{15}	e-mail or phone calls with friends
X_{16}	rumors from neighbors
X_{17}	rumors from people at the workplace
X_{21}	the frequency of phone calls
X_{22}	the frequency of e-mail with friends
X_{23}	frequency of communication with neighbors
X_{24}	frequency of communication with people at workplace
X_{31}	the number of bank accounts
X_{32}	type of main bank
X_{33}	the total amount of deposits
X_{34}	ratio of term deposit in total amount of deposits
X_{35}	annual income
X_{36}	recognition of deposit insurance system
X_{41}	gender
X_{42}	age
X_{43}	education
X_{44}	living area
X_{45}	married or not
X_{46}	type of employment

The results show that 9 kinds of the variables survive when we run the variable decrease method and 8 kinds of the variables survive when we run the variable increase method. The estimated results are sequentially shown in Tables 20 and 21, respectively.

Comparing table 20 with table 21, we find the following: First, estimated coefficient parameters of the degree of trust in information sources, weekly/monthly magazines, the Internet, and rumors form people at the workplace are statistically significant and the values are positive, respectively. Next, the estimated coefficient parameters of the frequency of e-mail with friends, the frequency of

Table 20: Estimated Result I

	B	Standard error	$\exp(B)$
b_{13}	0.161	0.075	1.174
b_{14}	0.169	0.078	1.184
b_{17}	0.224	0.073	1.251
b_{22}	0.205	0.062	1.228
b_{23}	0.093	0.046	1.097
b_{24}	0.086	0.034	1.090
b_{36}	-0.280	0.155	.756
b_{41}	0.264	0.118	1.302
b_{43}	0.102	0.038	1.108
Constant term	-3.257	0.414	.039

Table 21: Estimated Result II

	B	Standard error	$\exp(B)$
b_{13}	0.158	0.075	1.172
b_{14}	0.173	0.078	1.189
b_{17}	0.224	0.073	1.251
b_{22}	0.212	0.061	1.236
b_{23}	0.091	0.046	1.095
b_{24}	0.085	0.034	1.089
b_{41}	0.282	0.118	1.326
b_{43}	0.096	0.038	1.101
Constant term	-3.497	.394	.030

communication with people in the neighborhood and workplace are statistically significant and the values are positive, respectively. In addition, on the individual's relation in dealing with banks, the estimated coefficient parameter of the recognition of the deposit insurance system is statistically significant and the value is negative only in table 20. On individual attributes, the estimated coefficient parameters of gender and education are statistically significant and the values are positive. On the other hand, the estimated coefficient parameters of others are not statistically significant.

From the results of the Hosmer-Lemeshow test in Tables 22 and 23, we can evaluate how these models are fit to some degree because each model has a 5% or more significance level. In addition to these results, because the positive distinction rate is at a level between 64.1% and 65.5%, we can insist that our models are valid.

These results in this work are meaningful. The psychological aspect is important in our model, that is, we expect that psychological factors work strictly

Table 22: Hosmer-Lemeshow Test I (variable decrease method)

Chi 2 Square	Degree of freedom	Significance probability
9.742	8	0.284

Table 23: Hosmer-Lemeshow Test II (variable increase method)

Chi 2 Square	Degree of freedom	Significance probability
2.995	8	0.935

when individuals are likely to withdraw their deposits after receiving uncertain information on the financial environment. In particular, those who withdraw deposits easily are people who trust informal information, not formal information. Moreover, the more frequency of e-mail with friends, and communication with people in the neighborhood and at the workplace, the higher the probability that individuals will withdraw their deposits. To summarize, we expect that people who strictly trust in informal information and frequently communicate with people around them are likely to withdraw their deposits after receiving uncertain information on the financial environment. That is, if some people receive uncertain information even once about their financial environment, they would not only feel uncertain and withdraw their deposits, but they would also fuel uncertainness in the people around them. We imagine that this would easily cause a situation of panic.

On the other hand, we find economic valuables such as annual income and total amount of deposit are not bound in our model. This situation might make an economist, especially a macroeconomic researcher take a deep breath. However, by building a macroeconomic model with various economic variables and controlling some variables, many of macroeconomic researchers think that a situation of financial panic can be prevented. This fact therefore causes doubt in macroeconomic modeling. In addition, this doubt is attributable to whether or not individuals behave rationally.

Finally, we found that people who recognize the deposit insurance system are not likely to withdraw their deposits even if they receive uncertain information on the financial environment. This fact brings good news for policy-makers because policy-makers can stop depositors from withdrawing their deposits carelessly if depositors realize and understand that the deposit insurance system has been improved through decisions made by policy makers. Note however, that this fact cannot be confirmed in table 18.

Gender and education as individual attributes are bound. Also, we find that after receiving uncertain information on their financial environment, males would withdraw their deposits more easily than females, and highly educated people would be more likely to withdraw their deposits than the less educated.

5 Concluding Remarks and Future Work

In this work, we statistically investigated the relationships between the behaviors of individual depositors as to whether or not they will withdraw all of their deposits and factors such as the degree of trust in information sources, frequency of communication, individual relations of dealing with banks, and individual attributes. Our results show the following: First, individuals who trust in information sources such as weekly/monthly magazines, the Internet, and rumors from people at the workplace will be more likely to withdraw their deposits. Second, increases in phone call frequency with friends and frequency of communication in the neighborhood and workplace will also lead to more withdrawals. Third, when depositors receive uncertain information on the financial environment, the tendency to withdraw their deposits is affected by a difference between individual attributes such as gender and education. The message from these results is that banks and policy-makers have to pay attention to information sources so that they do not send information that unnecessarily causes panic. Moreover, banks must understand that a situation such as a bank run is caused if uncertain information is communicated. Policy makers must take advance countermeasures as part of a business continuity plan (abbreviation, BCP). On the other hand, economic variables such as annual income and total amount of deposit are not statistically significant. This may cast a shadow on classical macroeconomic modeling. Of course, more research is needed in the future as well as further exploration of the expansion of the models by using data at the individual level.

Finally, we show several issues remained for the future. First, one can point out bias of the Web-based survey's characteristic population. It is just a limit of this paper. Second, we can build the other economic model at individual level, for example, by using statistical framework such as covariance structure analysis. In the near future, we must solve these issues, and investigate more effective proposals.

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