

Technical Data on Subjective Time Discount Rates Measured Through a Web Survey in Japan

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I Introduction

The present technical data are obtained from the results of a web survey on subjective time discount rates of individuals in Japan. Respondents were asked to select their preferred option between two options: one offered a reward X , T years later, while the other offered a reward Y , $T + 1$ years later. Various conditions were set for the rewards (X and Y) and the delay (T) in giving the rewards. Our results suggest that the subjective time discount rates are inversely related with reward amounts. However, we cannot find clear evidence about the relationship between rates and delay conditions.

II Survey design

A web survey was conducted in February 2013 by NTTCom Online Marketing Solutions Corporation. For the survey, the 47 prefectures in Japan were divided into nine regions (**Table 1**). A total of 1,500 respondents were recruited from the survey panel members registered with the company. Recruitment for the survey was based on the condition that the sample characteristic ratios (i.e., gender ratio and age category (20s, 30s, 40s, and 50s) ratio) in each region correspond with the population characteristic ratios in each region, which were estimated as of October 1, 2011 (Ministry of Internal Affairs and Communications of Japan, 2012).

According to previous studies on subjective time discount rates (Morimoto, 2009; Ohtake and Tsutsui, 2012; Sasaki et al., 2012), the rate was captured by a question to the respondents on selecting their preferred option between two options: a reward X , T years later, or a reward Y , $T + 1$ years later (**Fig.1**). Time interval, which is the difference in value between $T + 1$ and T , is always 1 year. There were two versions of the survey: one set the reward X as JPY 10,000, while the other set the award as JPY 1 million (USD 1 \approx JPY 98 as of October 2013). Each respondent was randomly assigned either of the two versions of the survey. In both the survey versions, the respondents faced five questions, distinguished from each other by the condition of delay (T): Current, 1 year, 5 years, 10 years, and 20 years. In each of the five questions, nine values are set for Y , which is the reward offered on waiting for an additional year: X discounted at 5%, the same as X , an additional 2% on X , an additional 4% on X , an additional 6% on X , an additional 10% on X , an additional 20% on X , an additional 40% on X , and an additional of more than 40% on X . Thus, each of the five questions consists of nine pairs of options.

The subjective time discount rate for respondent i is calculated as the annual rate corresponding to his/her answers when he/she changed the response from “I will receive it T years later” to “I will receive it $T + 1$ years later.” For example, a respondent is assumed to select “I will receive it in the current period” from row numbers 1 to 3, while “I will receive it 1 year later” is selected from row numbers 4 to 9, in the question shown in Figure 1. The discount rate for the respondent is calculated at 4%. Respondents who met any of the following conditions in any of the five questions were excluded from the valid sample: (i) respondents who selected either “I receive it T years later” or “I will receive it $T + 1$ years later” for all nine pairs of options; (ii) respondents who changed their response from “I will receive it $T + 1$ years later” to “I receive it T years later” based on increase in reward Y ; and (iii) respondents with a discount rate of more than 40%.

Please select your preferred option in each line. Note that the price level is assumed to be stable across the period.

Serial No.	Amount of money received in the current period	Amount of money received 1 year later	Annual rate corresponding to the difference in the amount of money received between the two options	I will receive it in the current period	I will receive it 1 year later
1	10,000	9,500	-5%	<input type="radio"/>	<input type="radio"/>
2	10,000	10,000	0%	<input type="radio"/>	<input type="radio"/>
3	10,000	10,200	2%	<input type="radio"/>	<input type="radio"/>
4	10,000	10,400	4%	<input type="radio"/>	<input type="radio"/>
5	10,000	10,600	6%	<input type="radio"/>	<input type="radio"/>
6	10,000	11,000	10%	<input type="radio"/>	<input type="radio"/>
7	10,000	12,000	20%	<input type="radio"/>	<input type="radio"/>
8	10,000	14,000	40%	<input type="radio"/>	<input type="radio"/>
9	10,000	More than 14,000	More than 40%	<input type="radio"/>	<input type="radio"/>

Fig.1 A sample question (A case of “JPY 10,000” and “current”)

Table 1 Prefectures in each region

Region*	Prefectures
Hokkaido	Hokkaido
Tohoku	Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima
Hokuriku	Niigata, Toyama, Ishikawa, Fukui
Kanto (including Tosan**)	Ibaraki, Tochigi, Gunma, Saitama, Chiba, Tokyo, Kanagawa, Yamanashi, Nagano
Tokai	Gifu, Shizuoka, Aichi, Mie
Kinki	Shiga, Kyoto, Osaka, Hyogo, Nara, Wakayama
Chugoku	Tottori, Shimane, Okayama, Hiroshima, Yamaguchi
Shikoku	Tokushima, Kagawa, Ehime, Kochi
Kyushu (including Okinawa)	Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima, Okinawa

Note: * Category of regions is almost same as the agricultural regions used in The 2010 World Census of Agriculture and Forestry in Japan. ** Tosan consists of Yamanashi and Nagano prefectures.

ANOVA was conducted to test for difference in mean value for the rate variable. R (R Core Team, 2013) was used for the analysis.

III Result

Of the total 1,500 respondents, there were 987 valid respondents: 436 in the case of JPY 10,000 and 551 in the case of JPY 1 million; 513 respondents were rejected because they met conditions (i), (ii), or (iii) mentioned above.

Table 2 shows mean subjective time discount rates in the five questions (delays) based on the initial rewards (JPY 10,000 and JPY 1 million). In case of each delay, the rate for JPY 10,000 was significantly larger than that for JPY 1 million, suggesting the magnitude effect, that is, the inverse relationship between the discount rate and the amount of reward. The difference in rate among the delay conditions was also significant. However, rate in the case of “current” was significantly lower than those in the other four delay conditions ($P < 0.05$), while there was no difference in rate among the four delay conditions. This result does not provide strong evidence about the detection of the delay effect, which shows that the rate varies according to the delay conditions.

See appendix for cross tabulations according to gender category (Table A1), age category (Table A2), and region category (Table A3), indicating trends that are similar to those indicated in Table 2.

Table 2 Subjective discount rates

Delay*	JPY 10,000		JPY 1 million		Total	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Current	8.9	10.1	6.1	7.5	7.4	8.9
1 year late	10.6	12.0	7.8	9.3	9.0	10.7
5 years late	10.5	12.4	8.0	9.8	9.1	11.1
10 years late	10.0	11.7	8.0	9.9	8.9	10.8
20 years late	11.4	13.4	8.5	10.7	9.8	12.1
Average	10.3	10.1	7.7	8.1	8.8	9.1

Note: * Delay corresponds to “T years later” in the questions. Main effects are significant: $P < 0.001$ for the difference between JPY 10,000 and JPY 1 million; $P < 0.001$ for the difference among delay categories. Interaction effect between reward and delay is not significant.

IV Concluding remarks

The present survey suggested that the magnitude effect was detected in a web survey on subjective time discount rates, while the delay effect was not. The reason for this outcome will be investigated in further analysis. The present survey was financially supported by the Ministry of Agriculture, Forestry and Fisheries, Japan through a research project entitled “Development of technologies for mitigation and adaptation to climate change in Agriculture, Forestry and Fisheries.” I would like to thank the project members for their valuable comments on the survey design and the study results.

Appendix

Table A1 Subjective discount rates by gender category

(A) Male						
Delay	JPY 10,000		JPY 1 million		Total	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Current	11.2	11.4	7.1	8.0	8.9	9.8
1 year late	13.2	13.1	9.4	10.6	11.0	11.8
5 years late	13.2	13.9	9.4	10.7	11.0	12.3
10 years late	12.2	12.7	9.1	10.7	10.5	11.7
20 years late	13.5	14.3	9.6	11.5	11.3	12.9
Average	12.7	10.9	8.9	8.7	10.5	9.9
(B) Female						
Delay	JPY 10,000		JPY 1 million		Total	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Current	6.9	8.3	5.2	6.9	6.0	7.6
1 year late	8.4	10.6	6.2	7.5	7.2	9.1
5 years late	8.1	10.4	6.7	8.7	7.3	9.5
10 years late	8.0	10.3	6.9	9.0	7.4	9.6
20 years late	9.6	12.3	7.5	9.9	8.5	11.1
Average	8.2	8.8	6.5	7.4	7.3	8.1

Table A2 Subjective discount rates by age category

(A) 20's							
Delay	JPY 10,000		JPY 1 million		Total		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Current	7.8	9.6	5.3	6.7	6.4	8.2	
1 year late	9.0	11.5	7.0	8.4	7.9	9.9	
5 years late	8.9	11.3	7.6	9.8	8.2	10.5	
10 years late	7.8	10.4	7.1	9.3	7.4	9.8	
20 years late	8.4	11.6	7.4	10.6	7.8	11.0	
Average	8.4	8.9	6.9	7.3	7.6	8.1	

(B) 30's							
Delay	JPY 10,000		JPY 1 million		Total		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Current	7.8	9.5	6.1	7.9	6.9	8.7	
1 year late	9.8	12.0	7.2	9.4	8.4	10.7	
5 years late	9.7	12.5	7.6	9.7	8.6	11.1	
10 years late	9.0	11.8	7.6	9.8	8.2	10.7	
20 years late	10.3	13.3	7.8	9.8	9.0	11.5	
Average	9.3	10.0	7.3	8.4	8.2	9.2	

(C) 40's							
Delay	JPY 10,000		JPY 1 million		Total		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Current	10.5	11.5	5.9	7.5	7.9	9.6	
1 year late	12.0	12.7	7.2	8.5	9.2	10.7	
5 years late	12.7	14.0	7.4	9.3	9.7	11.8	
10 years late	11.8	12.5	8.0	10.3	9.7	11.4	
20 years late	12.1	12.9	8.9	11.1	10.2	12.0	
Average	11.8	11.4	7.5	8.2	9.3	9.9	

(D) 50's							
Delay	JPY 10,000		JPY 1 million		Total		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Current	10.0	9.7	7.2	7.7	8.3	8.7	
1 year late	12.0	11.8	9.9	10.5	10.7	11.1	
5 years late	10.8	11.0	9.6	10.6	10.1	10.8	
10 years late	11.7	11.2	9.5	10.4	10.4	10.8	
20 years late	16.1	15.0	10.2	11.6	12.7	13.4	
Average	12.1	9.4	9.3	8.4	10.5	8.9	

Table A3 Subjective discount rates by regional category

(A) Hokkaido							
Delay	JPY 10,000		JPY 1 million		Total		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Current	8.7	9.7	7.6	8.9	8.1	9.2	
1 year late	11.4	13.7	8.4	8.7	9.8	11.2	
5 years late	9.9	11.7	11.6	10.8	10.8	11.1	
10 years late	8.8	11.6	10.0	9.1	9.5	10.2	
20 years late	10.0	12.1	10.5	8.8	10.3	10.3	
Average	9.8	9.2	9.6	8.0	9.7	8.4	

(B) Tohoku							
Delay	JPY 10,000		JPY 1 million		Total		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Current	5.8	4.5	7.2	7.7	6.6	6.4	
1 year late	10.1	11.6	10.8	10.8	10.5	11.1	
5 years late	11.6	13.1	10.8	12.8	11.1	12.8	
10 years late	11.7	12.3	11.2	12.8	11.4	12.5	
20 years late	13.0	14.1	10.5	12.9	11.6	13.4	
Average	10.4	9.7	10.1	10.3	10.3	9.9	

(C) Hokuriku							
Delay	JPY 10,000		JPY 1 million		Total		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Current	12.2	15.6	5.7	9.0	8.7	12.6	
1 year late	11.2	14.1	6.2	8.7	8.5	11.6	
5 years late	10.6	14.4	7.4	9.3	8.8	11.8	
10 years late	7.3	10.2	9.1	13.0	8.3	11.7	
20 years late	10.3	12.4	9.9	13.4	10.1	12.8	
Average	10.3	11.2	7.7	9.6	8.9	10.3	

(D) Kanto							
Delay	JPY 10,000		JPY 1 million		Total		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Current	9.5	9.9	6.0	7.3	7.5	8.7	
1 year late	11.6	12.5	7.4	8.9	9.3	10.8	
5 years late	10.8	12.5	7.5	8.7	9.0	10.6	
10 years late	10.6	12.1	7.4	9.3	8.8	10.7	
20 years late	12.0	13.6	8.2	9.8	9.8	11.8	
Average	10.9	10.6	7.3	7.8	8.9	9.3	

(E) Tokai

Delay	JPY 10,000		JPY 1 million		Total	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Current	6.2	6.6	7.7	9.5	7.0	8.4
1 year late	7.3	7.7	9.6	11.6	8.6	10.2
5 years late	8.0	10.7	10.0	12.7	9.2	11.9
10 years late	7.1	8.8	9.0	11.0	8.2	10.1
20 years late	8.6	11.7	9.6	12.1	9.2	11.9
Average	7.4	7.2	9.2	9.6	8.4	8.7

(F) Kinki

Delay	JPY 10,000		JPY 1 million		Total	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Current	8.7	10.4	5.0	4.7	6.8	8.1
1 year late	9.8	11.2	6.1	6.6	7.9	9.3
5 years late	10.5	12.2	5.9	7.4	8.1	10.3
10 years late	9.8	11.9	6.5	7.5	8.1	10.0
20 years late	11.1	13.8	7.0	9.2	9.0	11.8
Average	10.0	9.7	6.1	5.6	8.0	8.1

(G) Chugoku

Delay	JPY 10,000		JPY 1 million		Total	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Current	8.3	8.6	6.5	9.0	7.2	8.8
1 year late	8.2	9.0	8.5	10.8	8.4	10.0
5 years late	9.8	12.4	8.8	11.1	9.2	11.6
10 years late	8.9	9.6	10.7	12.6	9.9	11.4
20 years late	9.5	11.3	9.1	12.6	9.3	11.9
Average	8.9	8.4	8.7	9.3	8.8	8.9

(H) Shikoku

Delay	JPY 10,000		JPY 1 million		Total	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Current	14.3	17.9	5.3	3.8	7.9	10.5
1 year late	10.0	13.8	8.7	8.0	9.1	9.7
5 years late	10.3	13.6	6.6	6.0	7.7	8.7
10 years late	16.6	17.3	6.1	6.1	9.2	11.3
20 years late	16.6	17.3	7.2	9.2	9.9	12.5
Average	13.5	15.0	6.8	5.7	8.8	9.5

(I) Kyushu

Delay	JPY 10,000		JPY 1 million		Total	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Current	10.2	12.3	5.5	7.2	7.7	10.1
1 year late	13.1	14.5	6.8	9.3	9.7	12.3
5 years late	11.6	13.6	7.3	10.2	9.2	12.0
10 years late	10.9	12.6	6.7	9.3	8.6	11.1
20 years late	13.4	14.9	8.3	11.7	10.7	13.4
Average	11.9	11.7	6.9	8.1	9.2	10.2

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Web 調査による主観的時間割引率の測定結果に関する技術資料

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要 旨

本技術資料は、Web 調査による主観的時間割引率の測定結果を報告する。2013 年 2 月、1500 名を対象とした Web 調査を実施した。回答者の主観的時間割引率は、「 T 年後に報酬 X 円が得られる状況」と「 $T+1$ 年後に報酬 Y 円が得られる状況」から望ましい方を選択させることで捉えた。報酬 X は 1 万円と 100 万円の 2 パターンを設定し、各回答者はどちらか一方の金額が設定された質問への回答を求められた。1 年待つことで得られる報酬 Y については、 X 円の 5% 引きから X 円の 40% 以上割増までの 9 パターンを設定した。回答者は、報酬 X が得られる状況と報酬 Y が得られる状況の 9 ペアで比較を行い、その選択が報酬 X から報酬 Y にシフトしたときの割引率を、その回答者の主観的時間割引率とした。各回答者は、期間 (T) の水準値が異なる 5 種類の質問 (今すぐ~20 年後) への回答を求められたため、回答者 1 名につき 5 種類の主観的時間割引率が得られた。有効回答者 987 名の分析の結果、主観的時間割引率は報酬額と反比例する関係が確認された一方、期間との関連も確認されたが、期間の水準間での差については一部に限定されていた。

キーワード：割引率，Web 調査，金額効果，遅延効果