Time Discounting and Intergenerational Altruism

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Abstract

This paper presents empirical evidence concerning time discounting and intergenerational altruism from unique U.S. and Japanese survey data. These data sets have been collected by Osaka University, and contain hypothetical questions about parental behavior and time discounting as well as socioeconomic variables. Our main finding is that parents' attitude depends on the magnitude of their time discount factor regarding their financial decisions. The empirical results are interpreted in terms of the tough love model of intergenerational altruism, and is consistent with the model.

Key Words: Intergenerational Altruism, Time Discounting, Tough Love

1   Introduction

This paper presents empirical evidence concerning time discounting and intergenerational altruism from unique U.S. and Japanese survey data collected by the Osaka University Global Center of Excellence (GCOE) program. These data sets have been collected by Osaka University, and contain hypothetical questions about parental behavior and time discounting for financial decisions as well as socioeconomic variables. Our main finding is that parents' attitudes toward their children depend on the magnitude of their time discount factor. These empirical results are consistent with recent intergenerational altruism models by Akabayashi (2006) and Bhatt and Ogaki (2008). In these models, the child has an endogenous discounting factor, and the parent uses a discount factor that is different from the child's in evaluating the child's life time utility.

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How different generations are connected is an important economic issue with implications for individual economic behavior like savings, investment in human and physical capital and bequests which in turn affect aggregate savings and growth. It also has nontrivial policy implications as in Barro (1974), who has found that there will be no net wealth effect of a change in government debt in the standard altruism model. Infinite horizon dynamic macro models are typically based on the standard altruism model proposed by Barro (1974) and Becker (1974) in which the current generation derives utility from its own consumption and the utility level attainable by its descendant.

Barro and Becker's standard altruism model does not predict parents' discipline behavior in situations in which we expect parents in our real lives to discipline their children. For example, a striking implication of the standard altruism model is that when the child becomes impatient, transfers from the parent to the child do not change when the child is borrowing constrained as Bhatt and Ogaki (2008,section III) showed. This implication of the model is not consistent with recent empirical evidence on pecuniary and non-pecuniary parental punishments (see Weinberg (2001), Hao, Hotz, and Jin (2008), and Bhatt (2008) for empirical evidence). For example, imagine that a child befriends a group of impatient children and suddenly becomes impatient because of their influence. As a result the child starts to spend more time playing with the new friends and less time studying. In worse cases, the child starts to smoke, drink, or consume illegal drugs (see Ida and Goto (2009) for empirical evidence that shows association of low discount factor and smoking). At least some parents are likely to respond by pecuniary punishments such as lowering allowances or non-pecuniary punishments such as grounding.

Bhatt and Ogaki modified the standard model to develop the tough love model of intergenerational altruism, so that it implies that the parent lowers transfers to the child when the child exogenously becomes impatient under a wide range of reasonable parameters. They modeled parental tough love by combining the two ideas that have been studied in the literature in various contexts. First, the child's discount factor is endogenously determined, so that low consumption at young age leads to a higher discount factor later in her life. This was based on the endogenous discount factor models of Uzawa (1968) except that the change in the discount factor is immediate in Uzawa's formulation whereas a spoiled child with high consumption progressively grows to become impatient in our formulation. Recent theoretical

models that adopt the Uzawa-type formulation include Schmitt-Grohé and Uribe (2003) and Choi, Mark, and Sul (2008). Second, the parent evaluates the child's lifetime utility function with a constant discount factor that is higher than that of the child. Since the parent is the social planner in our simple model, this feature is related to recent models (see Caplin and Leahy (2004); Sleet and Yeltekin (2005), (2007); Phelan (2006), and Farhi and Werning (2007)) in which the discount factor of the social planner is higher than that of the agents.

Akabayashi's (2006) model is similar to the tough love model in the sense that the child has an endogenous discounting and the parent evaluates his life time utility with a discount factor that is different from the child's. The main difference is that it employs Becker and Mulligan's (1997) endogenous discounting model in which accumulating human capital makes the child more patient and there exists an asymmetric information between the parent and the child. In this model, it is possible that the parent abuses the child in the sense that the parent keeps on punishing the child for his bad performance even though the child is simply not talented enough to perform better. Just as in Bhatt and Ogaki's model, Akabayashi's model predicts that the parent's discount factor that is used to evaluate the child's life time utility affects the parent's discipline behavior.

In this paper, we seek to examine whether or not parents' discount factors affect their attitude toward their children as predicted by these models. We use the Osaka University COE survey data for Japan and the United States, which include two hypothetical questions concerning tough love behavior. We use answers to these questions as dependent variables in our regressions. The main question we ask is how parents' tendencies for tough love behavior depend on various measures of time discounting for parents' own lending and borrowing over different time horizons.

Tough Love Altruism

This section presents a tough love altruism model that provides for a channel through which parents can influence the child's economic behavior. The model introduce the tough love motive of the parent via asymmetric time preferences between generations and endogenous discounting. This model predicts that the transfer to the child in period 1 will decrease when the child's discount factor exogenously decreases for a wide range of parameters. We use this model to interpret our empirical results.

Imagine a three-period model economy with two agents, the parent and

the child. For simplicity we consider the case of a single parent and a single child. The three periods considered are childhood, work and retirement. The model has six features. First, the parent cares about his own consumption but is also altruistic toward the child. He assigns a weight of η to his own utility where $0 < \eta < 1$. The child on the other hand is a non-altruist and derives utility only from her own consumption stream $\{C_t\}_{t=1}^3$. Second, the life of the parent and the child overlap only in period 1. Third, transfers, T, are made only in period 1.[6] Fourth, income of both the parent and the child is given exogenously. Fifth, the child is borrowing constrained in period 1. Lastly, there is no uncertainty in the economy. We will consider and compare four models in this economy.

In this model, the parent uses a constant and high discount factor to evaluate the child's lifetime utility while the child herself uses a discount factor which is endogenously determined as a decreasing function of her period 1 consumption:

$$\beta_{t,k}(C_1) \quad ; \quad \frac{\partial \beta_{t,k}}{\partial C_1} < 0.$$

With the borrowing constraint faced by the child in period 1, her discount factor is given by $\beta_{t,k}(y1 + T)$.

The underlying motivation for this type of endogeneity of the child's discount factor is the belief that the parent can spoil the child by giving her very high consumption during childhood, so that the child will grow to be a relatively impatient person. This in turn is motivated by the empirical evidence and evidence in the child psychology literature discussed in Bhatt and Ogaki (2008).

Now, the parent optimizes by solving the following optimization problem,

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[6]We assume that transfers are made from the parent to the child and there are no reverse transfers.

$$\max_{T} \left[\eta \, v(y_p - T) + (1 - \eta) \Big[u(y_1 + T) + \beta_{2,p} u(C_2^*) \right. \tag{1}$$

$$\left. + \beta_{2,p}\beta_{3,p} u(R(y_2 - C_2^*)) \Big] \right],$$

subject to

$$\{C_2^*\} \equiv \arg\max_{C_2} \left[u(C_2) + \beta_{3,k}(y1 + T)u(R(y_2 - C_2)) \right]. \tag{2}$$

In this tough love model there is no closed form solution to the parent's problem for any functional form for the utility function. Bhatt and Ogaki reports simulation results. When the discount factor that is used by the parent to evaluate the child's life time utility is higher than the discount factor of the child for the second and third periods, the parent decreases the transfer to the child in response to an exogenous drop in the child's discount factor, the parent decreases the transfer to the child for a wide range of parameter values. The intuition is that the parent prefers the child's consumption to grow at a faster rate (or drop at a slower rate) in this situation. This gives the parent a tough love incentive to decrease the transfer, so that the child will grow to be more patient. This incentive intensifies when the child's discount factor exogenously drops.

2 Data

The analyses in this paper are based on data from two questionnaire surveys: (1)Osaka University GCOE Program entitled "Preference and Life Satisfaction Survey" conducted in Japan(PLiSS-JAP); and the same survey conducted in the US (PLiSS-US).

A brief description of each survey follows. PLiSS-US and PLiSS-JAP is a panel study, which started in February 2004 as part of the Osaka University 21st Century Center of Excellence Program. PLiSS-JAP has been conducted annually since 2004 using a random sample drawn from 6,000 individuals by a placement@(self-administered) method. A new sample of 2,000 people which were traced was added to the 2006 survey. The 2008 survey also added a new sample of 3,000 people by mailing method. The data collection was continued

under the GCOE program in 2009. For this paper, we only used only the 2009 survey data because the cross-sectional sample size is the largest since 2004 in the PLiSS-JAP.

PLiSS-US is also a panel survey, and it began in January and February 2005 as part of the Osaka University 21st Century Center of Excellence Program. This mail survey was conducted with 12,338 individuals. In 2007 a new 2000 random sample of 2,000 individuals was added to the panel survey. The data collection was continued under the GOE program in 2009. This study used only 2009 survey data because the cross-sectional sample size is the largest since 2005 in the PLiSS-US.

2.1 Descriptive statistics

To evaluate the tough love attitudes of parents, we use the following two questions. We call these "Fever" and Concert" questions, respectively.

The Fever Question: Imagine that you have a 5-year old child that has a high fever and is in pain. The child's doctor tells you that both the fever and pain are harmless. He can give you a medicine that cures the sickness but slightly weakens the child's immune system when the child becomes 50 years old. What would you do? (X ONE Box)

1 □ I would give the medicine to the child if the sickness is known to last for one day.

2 □ I would give the medicine to the child if the sickness is known to last for two days.

3 □ I would give the medicine to the child if the sickness is known to last for one week.

4 □ I would give the medicine to the child if the sickness is known to last for one month.

5 □ I would not give the medicine to the child.

The Concert Question: Imagine that you have a 19-year old child that has been working at a restaurant for the last month. The child has been doing so to earn money to buy a concert ticket. You agreed that it would be all right for the child to buy the ticket as long as the child earns the necessary money. The child just got fired, and asked you to help by providing one tenth of the necessary money. The tickets will be sold out if you do not provide the money. What would you do in this situation? (X ONE Box)

X ONE Box)

1 ☐ I would provide the money regardless of the reason why the child got fired.

2 ☐ I would provide the money if the child is not at fault for being fired.

3 ☐ I would not provide the money because it is not good for my child.

4 ☐ I would not provide the money because it will be a waste of money.

The Fever Question: Imagine that you have a 5-year old child that has a high fever and is in pain. The child's doctor tells you that both the fever and pain are harmless. He can give you a medicine that cures the sickness but slightly weakens the child's immune system when the child becomes 50 years old. What would you do? (X ONE Box)

1 ☐ I would give the medicine to the child if the sickness is known to last for one day.

2 ☐ I would give the medicine to the child if the sickness is known to last for two days.

3 ☐ I would give the medicine to the child if the sickness is known to last for one week.

4 ☐ I would give the medicine to the child if the sickness is known to last for one month.

5 ☐ I would not give the medicine to the child.

We report the distributions of answers to the "Fever" and "Concert" in Figures 1 and 2, respectively. Table 1 shows summary statistics of answers to the questions we use. Panel A in Table 1 is the descriptive statistics in PLiSS-US and Panel B is the one in PLiSS-JAPUS.

For the "Fever" question, we interpret Answers 1-4 as parents' behaviors motivated by spoiling love with tougher love indicated by a higher numbered answer and Answer 5 as parents' behaviors motivated by tough love. With these interpretations, we conclude that 54.4% of American parents show tough love, while only 34.4% of Japanese parents show tough love to a 5-year old child. This result is not surprising given casual observations relatively little discipline children receive in Japan in their pre-school ages compared with children in the United States: it is relatively more often in Japan than in the United States to find pre-school children running around in restaurants or cafeterias while their parents do not do anything, for example.

Figure 2 shows the "Concert" distribution in each country. Compared with the "Fever" question, there are much less differences between the United States and Japan for this question. However, there are still some notable differences. The main difference between the United States and Japan is

for Answers 1 and 4. In the United States, 12.5% of the respondents chose Answer 1, while 16.9% chose Answer 1 in Japan. The faraction of people who chose Answer 4 is 5.7% in the United States, while the fraction is 1.3% in Japan. In the United States, 29.5% of the respondents chose Answer 3, while 52.7% chose Answer 3 in Japan.

For the "Concert" question, we interpret Answers 2 and 3 as parents' behaviors motivated by tough love (with tougher love indicated by Answer 3), Answer 1 as a behavior motivated by spoiling love,[7] and Answer 4 as a behavior motivated by parents' selfishness Here again, we recognize that Answer 4 may not indicate the parent's selfishness, but chose this wording to give a contrast with tough love. With these interpretations, we conclude that most parents show tough love to a 19-year old child in both countries because 81.9% chose Answers 2 and 3 in both the United States and in Japan. Among these parents, American parents are tougher as more of them chose Answer 3 rather than Answer 2 than Japanese parents. There are relatively more selfish parents in the United States than in Japan, even though there are only 5.7% selfish parents even in the United States.

If we assume that parents with higher discount factors for their own financial decisions use their higher discount factors to evaluate their children's life time utilities, then the tough love model predicts tougher parental behaviors toward their children for parents with higher discount factors for their own financial decisions. To test this hypothesis, we need data for parents' patience. PLiSS-US and PLiSS-JAP contains the questions about patience of respondents. We use the hypothetical questions to ask the attitude of intertemporal choices of receiving cash. There are 5 different questions in this type. These questions are for different settings about the timing of receiving (or paying) cash and the amount of receiving (or paying) cash.

We call the first of these five questions the "Impatience(1)" question. The question starts with "Let's assume you have two options to receive some money. You may choose Option "A", to receive $100 in two days; or Option "B", to receive a different amount in nine days. Compare the amounts and timing in Option "A" with Option "B" and indicate which amount you would prefer to receive for all 8 choices." Then it lists a table of 8 choices for the two options and the corresponding interest rate for each choice (see Appendix 1

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[7]We recognize that Answer 1 may be motivated love which does not spoil the child. We chose this wording for the purpose of clear communication that gives a contrast between what we call tough love and other kinds of love.

for more complete descriptions of these five questions.) Option B ranges from $99.81 to $105.74. These eight options correspond with the annual interest rates of -10%, 0%, 10%, 20%, 50%, 100%, 200%, and 300%, respectively. The "Impatience(2)" question starts with "Now let's assume that you have the option to receive $100 in ninety days or receive a different amount in ninety-seven days." For this question, the eight choices of Option B and the corresponding interest rates are the same at the "Impatience(1)" question. The "Impatience(3)" question starts with "Now let's assume that you have the option to receive $100 in one month or receive a different amount in thirteen months." For this question, Option B ranges from $95 to $140. These eight choices correspond with the annual interest rates of -5%, 0%, 2%, 4%, 6%, 10%, 20%, and 40%. The "Impatience(4)" question starts with "Now let's assume that you have the option to receive $10,000 in one month or receive a different amount in thirteen months." For this question, Option B ranges from $9,500 to $11,000. These eight choices correspond with the annual interest rates of -5%, 0%, 0.1%, 0.5%, 1%, 2%,6%, and 10%. The "Impatience(5)" question starts with "Now let's assume that you have the option to receive $10,000 in one month or pay a different amount in thirteen months." For this question, Option B ranges from $9,500 to $11,000. These eight choices correspond with the annual interest rates of -5%, 0%, 0.1%, 0.5%, 1%, 2%,6%, and 10%.

Thus the "Impatience(1)" question is about discounting between two days later and nine days later. The "Impatience(2)" question is about discounting between ninety days later and ninety-seven days later. The "Impatience(3)" question is about discounting between one month later and thirteen months later for $100. The "Impatience(4)" question is about discounting between the same time points in time, but for $10,000. The "Impatience(5)" question is about discounting between the same time points in time for $10,000 as the "impatience(4)" question, but is for paying rather than receiving.

We report these five patience proxies, which are calculated from the expected values of the range of designated in the questions. The calculation procedure is described in Appendix 2. For our regression analyses, we used a standardized mean of the first four patience proxies called "Impatience(1)", "Impatience(2)", "Impatience(3)", and "Impatience(4)" as our measure of patience. We took the mean to mitigate the measurement error problem. We used the difference between "Impatience(5)" and "Impatience(4)" as a measure of debt aversion. The descriptive statistics of these patience proxies are summarized in Table 1.

Table 1 also reports descriptive statistics for the socioeconomic variables, which are respondent's sex, age, race, education, having children dummy, log of household's income, and log of household's financial asset. The questions about the socioeconomic characteristics we used are in Appendix 1.

3 Empirical Results

We estimate the probit and multinomial probit models because the dependent variables, "Concert" and "Fever", are discrete choice questions. The data are pooled for the United States and Japan. The independent variables are patience proxy variable and socioeconomic variables. The results are presented in Tables 2-4 report the marginal effects.

3.1 The "Fever" Question

Tables 2 reports the results for the "Fever" question. Using our interpretation that Answer 5 indicates the tough love attitude as discussed in the last section, we construct the dependent variable by setting it to be 1 if Answer 5 is chosen and 0 otherwise. In column (1), we report the result when the debt aversion measure is not included as an independent variable. In column (2), we report the result when it is included.

First, we focus our discussion on the marginal effects of the impatience proxy. The sign of the point estimate of the coefficient is negative in each column. The marginal effect of the standardized mean of the patient proxies are statistically significant at the 1% level in each column. Thus the result for for the impatience proxy is consistent with the tough love model: when the parent has a higher discount rate (a lower discount factor) for his financial decisions, he is less likely to show tough love attitudes toward his young child.

Next, we focus on the marginal effect of the debt aversion measure. The result for the debt aversion measure suggests that parents with stronger debt aversion tend to show tough love attitudes toward their children. One idea to explain this result is that a parent with debt aversion obtains disutility from anticipations of future payments as in Caplin and Leahy's (2001) model. Such a parent will also obtain disutility from anxieties of future suffering of their children, and therefore will show tough love attitudes to accept current suffering of the child in order to avoid anxiety of future suffering. No formal model to incorporate this idea has yet been written. Nakagawa (2010)

shows that the model of positive anticipatory feelings can be transformed into a model that is similar to models with hyperbolic discounting functions. Therefore, it is likely that the tough love model that incorporates both anxieties and positive anticipatory feelings can explain our results.

Finally, we now turn to the marginal effects of other control variables. Male parents and people with more education years are more likely to have tough love attitudes. Japanese parents are less likely to show tough love attitudes than U.S. parents. These effects are statistically significant at the 1 % level.

3.2 The "Fever" and "Concert" Questions

Table 3 reports the results when we combine the "Fever" and "Concert" questions. For the "Fever" question, a parent who gives the medicine may have a selfish motivation to avoid their his own pain to have to hear the child cry. A parent who does not give the medicine may hava a selfish motivation to avoid his own expense for it. As a way to address this this issue, we combine the "Fever" and "Concert" questions by categorizing all the respondents who choose Answer 4 in the "Concert" question as selfish. From the remaining respondents, we categorize those who choose Answer 5 for the "Fever" question as showing tough love. The rest of the respondents are categorized as showing spoiling love.

With this modification, the results for spoiling love and tough love are similar to those of Table 2. The notable difference is that evidence for the debt aversion effect is stronger: the coefficient of the debt aversion measure is now statistically significant at the 1% level. Looking at the results for slfishness that are significant at least at the 5% level, we see that the parent who is younger than 30 years old, who lives in Japan, who has children, and who has more income is less likely to be selfish.

3.3 The "Concert" Question

Tables 4 reports the results for the "Concert" question. In constructing the dependent variable, we use our interpretation that Answer 1 indicates spoiling love; Answer 2 and 3, tough love; Answer 4, selfishness as discussed in the last section. Because there are three possible values, we use the multinomial probit model. We report results with the debt aversion measure in panel (1), and result without it in panel (2).

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First, we focus our discussion on the marginal effects of the impatience proxy. In both cases with and without the debt aversion measure, the point estimate for the spoiling love is positive and that for tough love is negative. These coefficients are significant at the 1% level. The coefficient for selfishness is not significant. The parent has a higher discount rate (a lower discount factor) for his financial decisions, he is less likely to show tough love attitudes toward his teenage child, and more likely to show spoiling love. This result is consistent with the tough love model just as in Tables 2 and 3.

Second, we focus on the marginal effects of the debt aversion measure. In contrast with Tables 2 and 3, none of the coefficients is significant at the conventional levels. This is consistent with the explanation for the "Fever question" that the people who obtain disutility form anxiety anticipation are more likely to show debt aversion. They have reasons to avoid anxiety of a child with weaker immune system in the future. On the other hand, anxiety anticipation does not play a role in the situation of the "Concert" question.

Finally, we turn to the marginal effects of other control variables in panel (1). In all cases, the sign of the coefficient for spoiling love and that for tough love are opposite. From these coefficients, we conclude that a male parent, a parent who is older than 50 years old, a parent who lives in Japan, a black parent, an Asian parent, a parent with less education years, a parent with smaller income, and a parent with smaller financial assets are more likely to have spoiling love attitudes rather than tough love attitudes. As for the effect on selfishness, we see that people under 39 years old, Japane3se people, and people with children, and people with higher income are less likely to be selfish toward their children.

4 Concluding Remarks

In this paper, we found empirical evidence that parents with lower time discount rates (higher discount factors) for their own financial decisions are more likely to behave toward their children with tough love. This evidence is consistent with the tough love model.

We also found that people with stronger debt aversion tend to be tough on their children when there is a possibility that their children will suffer in the distant future. This effect was not found when the possibility of their suffering is in the near future. These results are consistent with the idea that these people derive disutility from anxiety anticipation. A formal model for

this effect may be possible by combining models of Caplin and Leahy (2001) and Nakagawa (2010).

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Figure 1. Fever
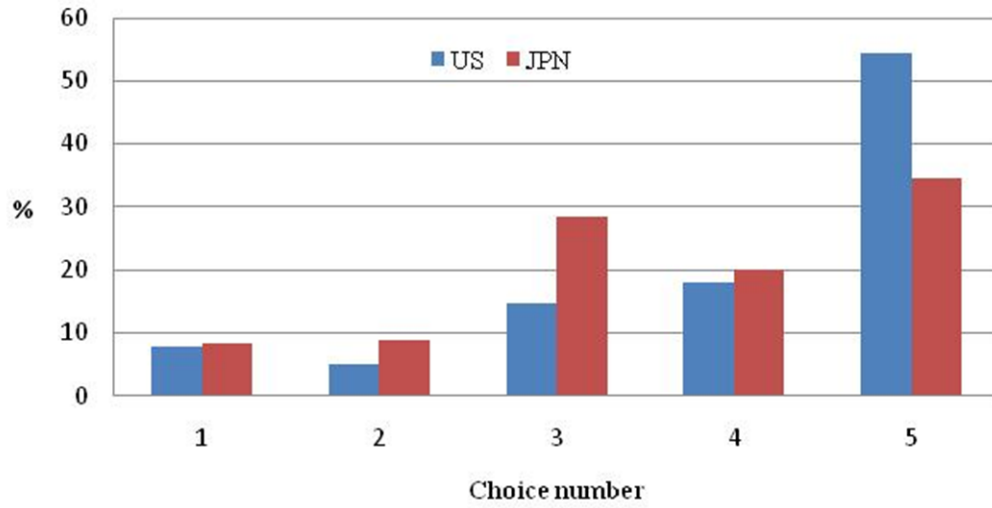
Note:

The choice number indicates the following:

1. I would give the medicine to the child if the sickness is known to last for one day.

2. I would give the medicine to the child if the sickness is known to last for two days.

3. I would give the medicine to the child if the sickness is known to last for one week.

4. I would give the medicine to the child if the sickness is known to last for one month.

5. I would not give the medicine to the child.

Figure 2. Concert
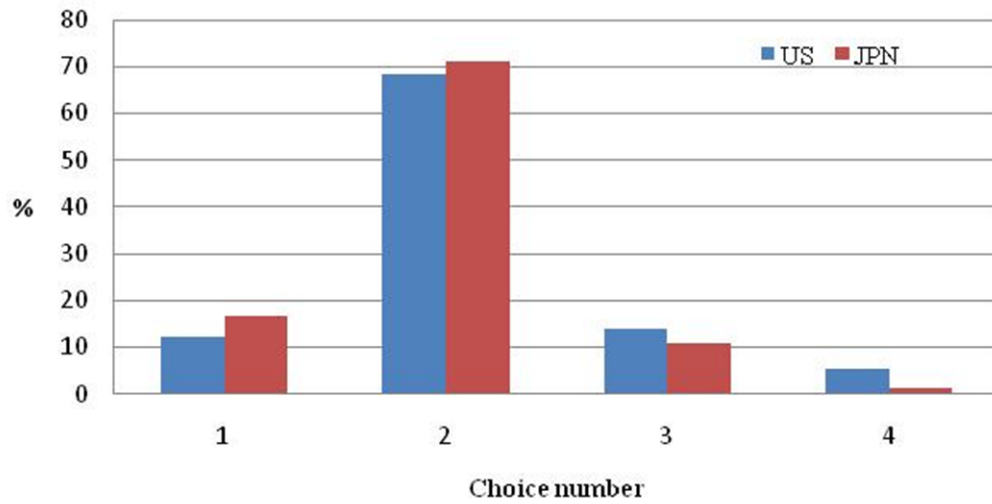
Note:

The choice number indicates the following:

1, I would provide the money regardless of the reason why the child got fired.

2. I would provide the money if the child is not at fault for being fired.

3. I would not provide the money because it is not good for my child.

4. I would not provide the money because it will be a waste of money.

Table 1. Descriptive Statistics

	Number of observations	Mean	Standard Deviation	Minimum	Maximum
Panel A. US					
Concert	6262	2.13	0.68	1.00	4.00
Fever	6211	4.06	1.27	1.00	5.00
Impatience(1)	6262	1.17	1.46	-0.45	3.58
Impatience(2)	6262	1.35	1.62	-0.51	3.77
Impatience(3)	6262	0.21	0.23	-0.07	0.54
Impatience(4)	6262	0.04	0.06	-0.07	0.13
Impatience(5)	5057	0.01	0.06	-0.07	0.13
Impatience(1)～(4) standardized mean	6262	0.00	0.82	-1.37	1.52
Impatience(4)-Impatience(5)	5057	0.03	0.08	-0.20	0.20
Respondent is male dummy	6262	0.48	0.50	0.00	1.00
Respondent's age	6262	44.84	15.95	18.00	95.00
under 30 years old dummy	6262	0.20	0.40	0.00	1.00
30-39 years old dummy	6262	0.19	0.39	0.00	1.00
40-49 years old dummy	6262	0.22	0.41	0.00	1.00
50-59 years old dummy	6262	0.21	0.41	0.00	1.00
60-69 years old dummy	6262	0.11	0.31	0.00	1.00
over 69 years old dummy	6262	0.08	0.26	0.00	1.00
Respondent's race					
white dummy	6262	0.83	0.38	0.00	1.00
black dummy	6262	0.09	0.29	0.00	1.00
asian dummy	6262	0.04	0.20	0.00	1.00
other race dummy	6262	0.04	0.20	0.00	1.00
Respondent's education years	6262	14.16	2.60	9.00	21.00
Having children dummy	6262	0.65	0.48	0.00	1.00
Log of household's income	6262	6.27	0.90	3.91	7.82
Log of household's financial asset	6262	6.61	1.49	4.83	9.43
Panel B. JPN					
Concert	4248	1.97	0.57	1.00	4.00
Fever	4214	3.64	1.26	1.00	5.00
Impatience(1)	4248	1.20	1.41	-0.46	3.57
Impatience(2)	4248	1.17	1.41	-0.46	3.56
Impatience(3)	4248	0.13	0.16	-0.07	0.47
Impatience(4)	4248	0.02	0.04	-0.06	0.11
Impatience(5)	3487	0.00	0.03	-0.06	0.11
Impatience(1)～(4) standardized mean	4248	0.00	0.86	-1.49	1.99
Impatience(4)-Impatience(5)	3487	0.03	0.05	-0.17	0.18
Respondent is male	4248	0.49	0.50	0.00	1.00
Respondent's age	4248	49.86	12.99	20.00	76.00
under 30 years old dummy	4248	0.07	0.26	0.00	1.00
30-39 years old dummy	4248	0.17	0.38	0.00	1.00
40-49 years old dummy	4248	0.23	0.42	0.00	1.00
50-59 years old dummy	4248	0.24	0.43	0.00	1.00
60-69 years old dummy	4248	0.24	0.42	0.00	1.00
over 69 years old dummy	4248	0.04	0.20	0.00	1.00
Respondent's education years	4248	13.08	2.13	9.00	16.00
Having children dummy	4248	0.82	0.39	0.00	1.00
Log of household's income	4248	6.36	0.68	3.97	7.88
Log of household's financial asset	4248	6.47	1.26	4.88	9.49

Table 2. Fever results

Dpendent variable: Choice 5. in fever	(1)		(2)	
Impatience(1)～(4) standardized mean	-0.021	***	-0.031	***
	(0.006)		(0.008)	
Impatience(4)-Impatience(5)			0.179	*
			(0.096)	
Male dummy	0.028	***	0.036	***
	(0.010)		(0.011)	
Under 30 years old dummy	-0.010		-0.002	
	(0.018)		(0.020)	
30-39 years old dummy	-0.004		-0.003	
	(0.016)		(0.017)	
50-59 years old dummy	0.008		0.013	
	(0.015)		(0.016)	
60-69 years old dummy	-0.005		-0.002	
	(0.017)		(0.019)	
Over 69 years old dummy	0.020		0.023	
	(0.023)		(0.027)	
JPN_dummy	-0.197	***	-0.185	***
	(0.011)		(0.012)	
Black dummy	-0.015		0.002	
	(0.022)		(0.026)	
Asian dummy	-0.026		0.004	
	(0.032)		(0.037)	
Other race dummy	0.004		0.001	
	(0.033)		(0.036)	
Education years	0.008	***	0.008	***
	(0.002)		(0.002)	
Having children dummy	0.004		0.001	
	(0.012)		(0.014)	
Log of household's income	0.007		0.004	
	(0.007)		(0.008)	
Log of household's financial asset	0.007		0.008	*
	(0.004)		(0.005)	
Observations	10468		8507	
Log likelihood	-6997		-5696	

Note:

1.This is estimated by probit model.

2. The esitimation retuls are marginal effect.

3. Standard errors are shown in the parenthese.

4. *,** and *** indicate the varuabls are sugnificant at 10%, 5% and 1% signficance level, respectively.

Table 3. Fever and Concert results

Dpendent variable: Concert

Choice	(1) N=10425			(2) N=8475		
	Spoilling love	Tough love	Selfish	Spoilling love	Tough love	Selfish
Impatience(1)～(4) standardized mean	0.018 ***	-0.019 ***	0.001	0.030 ***	-0.031 ***	0.001
Impatience(4)-Impatience(5)				-0.213 **	0.184 *	0.029
Male dummy	-0.024 **	0.023 **	0.002	-0.033 ***	0.032 ***	0.001
Under 30 years old dummy	0.010	0.003	-0.013 **	0.002	0.010	-0.012 **
30-39 years old dummy	0.005	0.003	-0.008	0.003	0.001	-0.003
50-59 years old dummy	-0.009	0.012	-0.003	-0.016	0.017	-0.002
60-69 years old dummy	-0.002	-0.001	0.004	-0.004	0.007	-0.003
Over 69 years old dummy	-0.012	0.007	0.005	-0.018	0.014	0.003
JPN_dummy	0.213 ***	-0.167 ***	-0.046 ***	0.203 ***	-0.159 ***	-0.043 ***
Black dummy	0.015	-0.012	-0.003	-0.001	0.008	-0.007
Asian dummy	0.034	-0.040	0.005	0.014	-0.018	0.005
Other race dummy	0.005	0.013	-0.018 *	0.016	0.004	-0.020 *
Education years	-0.007 ***	0.008 ***	-0.001	-0.008 ***	0.008 ***	0.000
Having children dummy	-0.004	0.012	-0.007 **	-0.002	0.007	-0.005
Log of household's income	-0.006	0.015 **	-0.008 ***	-0.003	0.009	-0.006 ***
Log of household's financial asset	-0.006	0.007 *	-0.001	-0.007	0.009 *	-0.002

Note:

1.This is estimated by multinominal probit model.

2. The esitimation retuls are marginal effect.

3. Standard errors are shown in the parenthese.

4. *, ** and *** indicate the varuabls are sugnificant at 10%, 5% and 1% signficance level, respectively.

Table 4. Concert results

Dpendent variable: Fever and Concert

Choice	(1) N=10510			(2) N=8544		
	Spoilling love	Tough love	Selfish	Spoilling love	Tough love	Selfish
Impatience(1)~(4) standardized mean	0.014 ***	-0.015 ***	0.000	0.019 ***	-0.020 ***	0.000
Impatience(4)-Impatience(5)				-0.090	0.064	0.026
Male dummy	0.028 ***	-0.030 ***	0.002	0.033 ***	-0.034 ***	0.001
Under 30 years old dummy	-0.012	0.026 **	-0.014 **	-0.021	0.032 **	-0.011 **
30-39 years old dummy	-0.031 ***	0.038 ***	-0.007	-0.041 ***	0.044 ***	-0.004
50-59 years old dummy	0.022 **	-0.018 *	-0.004	0.020 *	-0.019 *	-0.001
60-69 years old dummy	0.021 *	-0.022 *	0.002	0.013	-0.011	-0.002
Over 69 years old dummy	0.036 **	-0.038 **	0.002	0.041 **	-0.046 **	0.004
JPN_dummy	0.047 ***	-0.002	-0.045 ***	0.047 ***	-0.004	-0.043 ***
Black dummy	0.068 ***	-0.066 ***	-0.003	0.067 ***	-0.060 ***	-0.007
Asian dummy	0.077 ***	-0.082 ***	0.005	0.070 ***	-0.075 ***	0.005
Other race dummy	0.032	-0.014	-0.018 *	0.036	-0.016	-0.019 *
Education years	-0.004 **	0.005 ***	-0.001	-0.004 **	0.004 **	0.000
Having children dummy	0.009	-0.002	-0.007 **	0.001	0.003	-0.004
Log of household's income	-0.003	0.012 **	-0.008 ***	-0.004	0.010 *	-0.006 ***
Log of household's financial asset	-0.007 **	0.008 ***	-0.001	-0.008 **	0.010 ***	-0.002

Note:

1.This is estimated by multinominal probit model.

2. The esitimation retuls are marginal effect.

3. Standard errors are shown in the parenthese.

4. *, ** and *** indicate the varuabls are sugnificant at 10%, 5% and 1% signficance level, respectively.

Appendix 1

Household income

Approximately how much was the annual earned income before taxes and with bonuses included of your <u>entire household</u> for 2007?   *(If you are student, please answer the income of your parents' entire household.)*

(X ONE Box)

01 Y Less than $10,000	07 Y $100,000 to less than $120,000
02 Y $10,000 to less than $20,000	08 Y $120,000 to less than $140,000
03 Y $20,000 to less than $40,000	09 Y $140,000 to less than $160,000
04 Y $40,000 to less than $60,000	10 Y $160,000 to less than $180,000
05 Y $60,000 to less than $80,000	11 Y $180,000 to less than $200,000
06 Y $80,000 to less than $100,000	12 Y More than $200,000

Household financial asset

Approximately how much would the balance of financial assets (savings, stocks and insurance, etc.) of your entire household be?   *(If you are a student, please answer the balance of financial assets of your parents' entire household.)* **(X ONE Box)**

01 Y Less than $25,000	06 Y $150,000 to less than $200,000
02 Y $25,000 to less than $50,000	07 Y $200,000 to less than $300,000
03 Y $50,000 to less than $75,000	08 Y $300,000 to less than $500,000
04 Y $75,000 to less than $100,000	09 Y $500,000 to less than $1,000,000
05 Y $100,000 to less than $150,000	10 Y $1,000,000 or more

Impatience(1)

Let's assume you have **two options** to receive some money.
You may choose Option "A", to receive $100 in **two days**; or Option "B", to receive a different amount in **nine days**.   *Compare the **amounts** and **timing** in Option "A" with Option "B" and indicate which amount you would prefer to receive for all 8 choices.*

Option "A" Receiving In 2 Days	or	Option "B" Receiving In 9 Days	Includes An Annual Interest Rate Of:	→	Which <u>ONE</u> do you prefer? (X ONE Box For EACH Row) Option "A"	Option "B"
$100.00	or	$99.81	-10%....................................	→	1 Y	2 Y
$100.00		$100.00	0%....................................		1 Y	2 Y

$100.00	$100.19	10%..................................... ₁ Y	₂ Y
$100.00	$100.38	20%..................................... ₁ Y	₂ Y
$100.00	$100.96	50%..................................... ₁ Y	₂ Y
$100.00	$101.91	100%..................................... ₁ Y	₂ Y
$100.00	$103.83	200%..................................... ₁ Y	₂ Y
$100.00	$105.74	300%..................................... ₁ Y	₂ Y

Impatience(2)

Now let's assume that you have the option to receive $100 in **ninety days** or receive a different amount in
ninety-seven days.   *Compare the **amounts** and **timing** in Option "A" with Option "B" and indicate which amount you would prefer to receive for all 8 choices.*

Option "A" Receiving In 90 Days	or	Option "B" Receiving In 97 Days	Includes An Annual Interest Rate Of:	→	Which ONE do you prefer? (X ONE Box For EACH Row) Option "A"	Option "B"
$100.00		$99.81	-10%..................................... ₁ Y		₂ Y	
$100.00		$100.00	0%..................................... ₁ Y		₂ Y	
$100.00		$100.19	10%..................................... ₁ Y		₂ Y	
$100.00		$100.38	20%..................................... ₁ Y		₂ Y	
$100.00		$100.96	50%..................................... ₁ Y		₂ Y	
$100.00		$101.91	100%..................................... ₁ Y		₂ Y	
$100.00		$103.83	200%..................................... ₁ Y		₂ Y	
$100.00		$105.74	300%..................................... ₁ Y		₂ Y	

Impatience(3)

Now let's assume that you have the option to receive $100 in **one month** or receive a different amount in **thirteen months**.   *Compare the **amounts** and **timing** in Option "A" with Option "B" and indicate which amount you would prefer to receive for all 8 choices.*

Option "A" Receiving In 1 Month	or	Option "B" Receiving In 13 Months	Includes An Annual Interest Rate Of:	→	Which ONE do you prefer? (X ONE Box For EACH Row) Option "A"	Option "B"
$100		$95	-5%..................................... ₁ Y		₂ Y	
$100		$100	0%..................................... ₁ Y		₂ Y	
$100		$102	2%..................................... ₁ Y		₂ Y	
$100		$104	4%..................................... ₁ Y		₂ Y	
$100		$106	6%..................................... ₁ Y		₂ Y	
$100		$110	10%..................................... ₁ Y		₂ Y	
$100		$120	20%..................................... ₁ Y		₂ Y	
$100		$140	40%..................................... ₁ Y		₂ Y	

Impatience(4)

Now let's assume that you have the option to receive $10,000 in **one month** or receive a different amount in **thirteen months**. *Compare the **amounts** and **timing** in Option "A" with Option "B" and indicate which amount you would prefer to receive for all 8 choices.*

Option "A" Receiving In 1 Month	or	Option "B" Receiving In 13 Months	Includes An Annual Interest Rate Of:	→	Which ONE do you prefer? (X ONE Box For EACH Row)	
					Option "A"	Option "B"
$10,000		$9,500	-5%..		₁ Y	₂ Y
$10,000		$10,000	0%...		₁ Y	₂ Y
$10,000		$10,010	0.1%.......................................		₁ Y	₂ Y
$10,000		$10,050	0.5%.......................................		₁ Y	₂ Y
$10,000		$10,100	1%...		₁ Y	₂ Y
$10,000		$10,200	2%...		₁ Y	₂ Y
$10,000		$10,600	6%...		₁ Y	₂ Y
$10,000		$11,000	10%..		₁ Y	₂ Y

Impatience(5)

Now let's assume that you have the option to **pay** $10,000 in **one month** or **pay** a different amount in **thirteen months**. *Compare the **amounts** and **timing** in Option "A" with Option "B" and indicate which amount you would prefer to **pay** for all 8 choices.*

Option "A" Paying In 1 Month	or	Option "B" Paying In 13 Months	Includes An Annual Interest Rate Of:	→	Which ONE do you prefer? (X ONE Box For EACH Row)	
					Option "A"	Option "B"
$10,000		$9,500	-5%..		₁ Y	₂ Y
$10,000		$10,000	0%...		₁ Y	₂ Y
$10,000		$10,010	0.1%.......................................		₁ Y	₂ Y
$10,000		$10,050	0.5%.......................................		₁ Y	₂ Y
$10,000		$10,100	1%...		₁ Y	₂ Y
$10,000		$10,200	2%...		₁ Y	₂ Y
$10,000		$10,600	6%...		₁ Y	₂ Y
$10,000		$11,000	10%..		₁ Y	₂ Y

Appendix 2

The patience variables, "patience(1)",…, "patience(5)" are estimated through the
following procedure. In the questionnaires, a respondent was supposed to choose
appropriate range containing the corresponding amount of receiving cash, instead of
writing down the exact figures. Using that information, the expected value of each
classification will be estimated as follows.

First, assume that each of those income variables, θ, follow the log-normal
distribution, or

$$x \equiv \ln\theta \sim N(\mu, \sigma)$$

where μ and σ denote the mean and standard deviation of the normal distribution
respectively. When there are J classes $(c = 1, \dots, J)$, the probability for θ of individual
i, $x_i = \ln\theta_i$ i to be jth class can be expressed as:

in jth class can be expressed as:

$$P(c = j) = P\left(\ln\underline{\theta}_j < x_i < ln\overline{\theta}_j\right) = \Phi\left(\frac{\ln\overline{\theta}_j - \mu}{\sigma}\right) - \Phi\left(\frac{\ln\underline{\theta}_j - \mu}{\sigma}\right),$$

where $\overline{\theta}_j$ and $\underline{\theta}_j$ means the upper and lower bounds of θ respectively in the Jth class,
printed in the questionnaires. The mark Φ, in addition, denotes the cumulative
distribution function of the normal distribution. The logarithm of the above probability
with respect to every respondent will constitute a log-likelihood function defined as:

$$L(\mu, \sigma|c) = \sum_{i \in I} \sum_{j \in J} 1[c_i = j] \ln P(c = j)$$

Let $1[c_i = j]$ signifies the variable to take one for the inclusion of individual i in class
j; otherwise, it equals zero. The letter I and J indicate the total number of respondents
and classes respectively. Employing the parameter μ and σ through the maximum

likelihood estimation with the log-likelihood function, each expected value of θ in J can be calculated with the following equation (Kimball et al., 2005).

$$E(\theta_i|\ln\underline{\theta}_j < x_i < ln\overline{\theta}_j) = \exp\left(\mu + \frac{\sigma^2}{2}\right) \frac{\int_{\ln\underline{\theta}_j}^{\ln\overline{\theta}_j} \frac{1}{\sqrt{2\pi}\sigma} \exp\left(\frac{-(y - \mu - \sigma^2)^2}{2\sigma^2}\right) dy}{\int_{\ln\underline{\theta}_j}^{\ln\overline{\theta}_j} \frac{1}{\sqrt{2\pi}\sigma} \exp\left(\frac{-(y - \mu)^2}{2\sigma^2}\right) dy}.$$