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The Effects of Personality on Intertemporal Choice

Nicholas Hogan

Honors College, Pace University

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THE EFFECTS OF PERSONALITY ON INTERTEMPORAL CHOICE

Nicholas Hogan

Graduation Date: May 2015

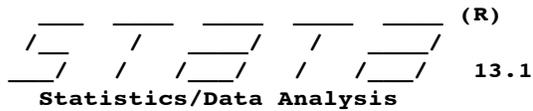
Major: Business Economics

Advisor: Dr. Joseph Morreale

Department: Chair of the Economics Department

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13.1

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Notes:

1. You are running Small Stata.

```
1 .  
2 .  
3 . import delimited "/Users/Nicholas/Desktop/Thesis Trial 2.csv"  
   (5 vars, 204 obs)  
4 . summarize
```

Variable	Obs	Mean	Std. Dev.	Min	Max
itc1	204	84.89706	61.59933	8	140
itc2	204	102.6593	71.803	10	165
grade	204	3.093137	1.405882	1	5
gender	204	.627451	.4846728	0	1
pbt	204	42.69118	4.989419	30	54

```
5 . tabulate grade
```

GRADE	Freq.	Percent	Cum.
1	41	20.10	20.10
2	33	16.18	36.27
3	32	15.69	51.96
4	62	30.39	82.35
5	36	17.65	100.00
Total	204	100.00	

```
6 . regress itc1 grade gender pbt
```

Source	SS	df	MS	Number of obs =	204
--------	----	----	----	-----------------	-----



Model	837.460535	3	279.153512	F(3, 200) = 0.07
Residual	769441.378	200	3847.20689	Prob > F = 0.9746
Total	770278.838	203	3794.47704	R-squared = 0.0011
				Adj R-squared = -0.0139
				Root MSE = 62.026

itc1	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
grade	.2776935	3.157278	0.09	0.930	-5.948132	6.503519
gender	-2.668092	9.218656	-0.29	0.773	-20.84632	15.51014
pbt	-.3333983	.8977591	-0.37	0.711	-2.103686	1.43689
_cons	99.94538	42.87015	2.33	0.021	15.40989	184.4809

7 . hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
 Ho: Constant variance
 Variables: fitted values of itc1

chi2(1) = **0.08**
 Prob > chi2 = **0.7725**

8 . regress itc2 grade gender pbt

Source	SS	df	MS	Number of obs = 204
Model	5703.07295	3	1901.02432	F(3, 200) = 0.37
Residual	1040898	200	5204.49	Prob > F = 0.7782
Total	1046601.07	203	5155.67031	R-squared = 0.0054
				Adj R-squared = -0.0095
				Root MSE = 72.142

itc2	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
grade	-.5861581	3.672224	-0.16	0.873	-7.827403	6.655087
gender	6.97885	10.7222	0.65	0.516	-14.16422	28.12192
pbt	-.6936455	1.044182	-0.66	0.507	-2.752664	1.365373
_cons	129.706	49.86219	2.60	0.010	31.38298	228.0291

9 . hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
 Ho: Constant variance
 Variables: fitted values of itc2

chi2(1) = **0.00**

User: Nicholas Hogan Project: Undergraduate Thesis

Prob > chi2 = **0.9733**

10 .

Abstract

This dissertation attempts unveil new information concerning intertemporal choice, by trying to find a correlation between personality and the temporal choices that people make. The methodology for doing so is as follows: a survey was distributed and responses were regressed using Ordinary Least Squares (OLS). Given that there were two questions (one formatted using a calendar date and the other using a word format) about intertemporal choice (subjects were asked to choose a certain payoff corresponding to a specific point in time), there were two models constructed. Each model had the following variable structure: the dependent variable was the expected payoff, while the independent variables were gender, grade, and most importantly, the point total corresponding to the questions about personality. The results of the regression were not statistically significant, most likely majorly due to the smaller sample size of 204 observations as well as a possible presence of a sample bias of college students; however, interesting coefficient sign changes in gender and grade occurred between the two models. Furthermore, the coefficient sign on both models for the point total variable was negative, showing that the more self-interested someone is (according to a personality test), the more present-gain oriented they seem to be. A repetition of the experiment on a grander scale will either confirm or deny these variables' role in deciding expected payoffs involving intertemporal choices.

1 Introduction

Would you rather have \$50 now, or \$100 a month from now? Intertemporal choice arises when people have to choose between two or more payoffs at different times.

In other words, it is how people discount different payoffs when time changes. Understanding time is crucial in order to grasp the concept of intertemporal choice. Scientific American elucidates this through the “arrow of time”, a continuous linear concept of time: “But whereas we spend our days passing freely through space in any direction we wish (gravity and solid obstacles permitting), time pushes us along, willingly or not, in a single predetermined direction: toward the future. This is the arrow of time—life carries us from the past, through the present, and into the future” (*What Keeps Time Moving Forward? Blame it on the Big Bang*, Matson, John). One way to envision the disconnect between intertemporal choice is through the consumption puzzle (the “puzzle” being that long-run consumption and short-run consumption have constant and falling APC, respectively). In essence, this is a choice about utility: “a decision maker needs to trade off the utility (or value) of one outcome that is temporally proximal (typically intermediate) with another one that is temporally distant” (Soman et al., *The Psychology of Intertemporal Discounting: Why are Distant Events Valued Differently from Proximal Ones*, 2005).

Many approaches have been taken in order to attempt to discover reasons why people can act irrationally when making temporal decisions, and to try to find why some make more extreme decisions than others. There have been approaches from a vast amount of fields, including psychology, economics, neuro-economics, and many others. Furthermore, the extent of the methodology used in each experiment is even more immense. Despite the differences, what each respective research project does conclude, however, is that people do not always tend to act rationally when faced with making temporal choices.

Richard Thaler elaborates on the winner's curse concept in his paper *Anomalies: The Winner's Curse*, where he mentions that "the winner's curse cannot occur if all the bidders are rational, so evidence of a winner's curse in market settings would constitute an anomaly" (*Journal of Economic Perspectives*, Volume 2, Number 1, Winter 1988, p. 192). For those who are not familiar with the winner's curse, the winner's curse occurs when the highest bidder for something is "cursed" in one of two ways: "(1) the winning bid exceeds the value of the tract, so the firm loses money; or (2) the value of the tract is less than the expert's estimate so the winning firm is disappointed" (Thaler, p. 192). The "key ingredient" for this, as Thaler says, "is the existence of a cognitive illusion, a mental task that includes a substantial majority of subjects to make a systematic error" (Thaler, p. 201). Soman et al. (2005) believe something very similar: "because individuals are myopic, they over-emphasize short-term benefits relative to long-term benefits" (p. 352).

One factor for these decisions can be found in Mitchell, Schirmer, Ames, and Gilbert (2011). In their study, they conclude that, "people may tend to think of their future selves not as they think of their present selves but as they think of other people" (*Medical Prefrontal Cortex Predicts Intertemporal Choice*, *Journal of Cognitive Neurosciences* 23:4, p. 1). This neurological approach was able to capture the difference in brain activity in a specific region (ventro-medial pFC, vPMC) and relate it to temporal choice.

Another factor can be found in a completely different approach. Dshemuchadse, Scherbaum, and Goschke (2012) use a computerized approach to capture their findings. By storing data in the computers used for testing (such as cursor movement, time lapse for cursor movement, etc.), they observed, "less direct mouse movements when

participants chose later/larger rewards, indicating that participants had to overcome the attraction of the sooner/smaller reward first” (*How Decisions Emerge: Action Dynamics in Intertemporal Decision Making*, Journal of Experimental Psychology, Vol 142, p. 93). Furthermore, their findings led to the hypothesis that, “impulsivity forces people to discount future rewards more steeply than rational choice models would prescribe” (p. 93).

One of the most common models for expected outcomes is the expected utility theory model. Kahneman and Tversky (1979) disagreed with the validity of the expected utility model, and created a new theoretical model: prospect theory. This new theory differs from the expected utility theory mainly in that the weighting function is not a matter of probability, but that of the impact of events on the desirability of prospects. Both the expected utility model and the prospect theory model are best attempts at trying to establish rational preferences in terms of outcomes.

That being said, a different theory, called present theory, is seemingly a better predictor at sequential studies rather than a single-shot study. To illustrate this theory and its implications, Rachlin (1990) uses a sports gambler: “a compulsive sports gambler, for instance, bets on several games in a day and, according to present theory, resets accounts after each win.” Therefore, even if said gambler lost one-hundred bets before he or she won one bet, he or she would forget about those losses and use the fact of winning as justification to continue betting.

Additionally, Wathieu (1997) constructs a discounted utility model under habit formation. Habit formation means that, “the outcome in each period is evaluated in

comparison with what the decision maker has been accustomed to.” Habit formation, as a concept, is important to understand, as individuals have the ability to craft a habit of what outcomes they would like to receive. As it turns out, Waithieu (1997) was able to relate two anomalies to habit formation: “two major anomalies in intertemporal choice (decreasing impatience and negative time preference) can be jointly explained and viewed as intuitive properties of a single discounted utility model under habit formation.” In other words, decreasing impatience and negative time preference can be explained through habit formation, and therefore a discount utility model under habit formation should take these variables into consideration.

One anomaly that has been growing in the discussion of intertemporal choice is the “date/delay effect”. This “effect” occurs when people discount items differently while looking at date forms of time versus delay forms of time (e.g. one year). This effect has becoming more and more apparent in studies involving intertemporal choice. One example is in Dshemuchadse, et al. (2012), where their results suggested, “that a change in the weighting of the value information is a possible source of the date-delay effect.” By replicating previous findings, they found a “stronger temporal discounting when the time intervals of the options were presented as delays rather than calendar dates.” Additionally, Read, Frederick, Orsel, and Rahman (2005), take on the task of identifying the date/delay effect in five different experiments. In all of the experiments that Read et al. (2005) conducted, there was evidence of the existence of the date/delay effect: “People exhibit less discounting when time intervals are described as dates than when they are described as delays.” These aforementioned studies are only a few that have touched upon this effect in academia. The existence and importance of this

effect only illustrates more clearly that there is much to investigate and uncover in the world of intertemporal choice.

Gilman, Curran, Calderon, Stoeckel, and Evins (2014) indicate that, “discounting rates can be modulated by social influence.” In their study, Gilman et al. (2014) were able to see that social influence can play a role when young adults make intertemporal choices. Given that the majority of the subjects that will be surveyed are young adults (college population), it is important to try to minimize this effect on in this survey. If this issue is not addressed, one could run the risk of having faulty or skewed data. Individual and original responses are crucially important. Unlike the other research analyzed for this project, the method and goal of Curran et al. (2004) was unique, and could have implications on past studies.

In addition to the date/delay effect, Magen, Dweck, and Gross (2008) uncover that there might be another effect to consider: how the payoffs are formatted. In Magen et al. (2008), the payoffs were listed in two forms: hidden-zero and explicit-zero. According to their results, “the hidden-zero and explicit-zero formats of presentation were logically equivalent, the latter resulted in lower rates of impulsive choice.” Magen et al. (2008) attribute this to the possibility that the explicit-zero format might make the opportunity cost more prevalent to those undergoing the experiment.

Also, it appears that temporal choice can be affected by gender: “men discounted the future more after considering the appeal of pictures of pretty women . . . we believe that this is the first demonstration of an experimentally induced change in human discounting” (Wilson and Daly, 2004). Pictures of attractive women alone were enough

to make men discount more than women did in a similar situation. Decisions regarding temporal choice are seemingly multifaceted, which makes fully understanding the topic even more difficult.

A slightly different approach was taken by Caruso, Van Boven, Chin, and Ward (2012), where they tested subjects in virtual movement as well as traditional methods: "some people had the (virtual) experience of moving forward in space, consistent with their natural orientation of thoughts, whereas others had the (virtual) experience of moving backward in space, reversing their natural orientation of thoughts." The reason behind this study was that, "the future is psychologically closer than the past because the future typically approaches the present whereas the past recedes from the present." The results of this experiment illustrated that, "people tended to report that times were psychologically closer when their spatial movement corresponded with their metaphorical temporal location" (Caruso et al. 2012). This reveals that human tendency is to think of time as forward moving, rather than backwards moving.

Andrew Haldane, one of the Executive Directors at the Bank of England, discusses the effect of impatience and short-termism on financial markets and society at large: "Evidence from social and economic systems points to two evolutionary paths. Along one, patience becomes self-reinforcing. For example, financial liberalization (the deregulation of financial markets in a country) may encourage patience and improve inter-temporal choice, unlocking growth. But there is a second path, along which impatience is self-reinforcing. Financial liberalization can also unlock impatience, generating over-trading and under-investment. These dual equilibria make choosing the right pace and path of financial reform crucial" (*Andrew Haldane: Patience and Finance*).

To illustrate this in terms of holding of US Equities, Haldane says the following: "In 1940, the mean duration of US equity holdings by investors was around 7 years. For the next 35 years up until the mid-1970s, this average holding period was little changed. But in the subsequent 35 years average holding periods have fallen secularly. By the time of the stock market crash in 1987, the average duration of US equity holdings had fallen to under 2 years. By the turn of the century, it had fallen below one year. By 2007, it was around 7 months. Impatience is mounting" (*Andrew Haldane: Patience and Finance*). Clearly, people have been continuing down a path of being impatient, and there is no evidence that this trend will end. If it holds that people are becoming less patient, this should also hold in any study questioning intertemporal choice if the results can be compared to the same subjects in the past.

Furthermore, additional research reveals that individual risk attitudes can affect intertemporal choice: "Reward neurons encode risk separately from value (see Schultz et al. 2008). Prefrontal risk signals differ between risk avoiders and risk takers. Risk reducers value signals in risk avoiders and increases value signals in risk takers. Thus, individual risk attitudes may reflect variations of prefrontal function" (*Brain Wave Project, The Royal Society, pg. 62*). This difference in risk attitudes lead to decisions that have the possibility of not being the best possible choices for an individual: "We know that certain reward values are coded 'inaccurately' in the brain. For example, we know that the reward processes in the striatum tend to discount the values of future rewards (temporal value discounting). This may be a factor that leads us to invest less in provisions for the future (such as education, healthcare or pensions) than we 'should' do"

(*Brain Wave Project 1*, The Royal Society, pg. 65). If different risk attitudes are the cause, it would be reasonable to attempt to try and derive those attitudes from individuals.

One area of research that hasn't attracted much attention is how personality, if at all, correlates to temporal choice. This paper will use the methodology that will be discussed in the upcoming section in order to see if there is a relationship between someone's personality and his/her intertemporal choices. Knowing this information (whether or not the results are significant) will arm the academic community with more knowledge about this deep and complex subject.

2 Experiment and Hypothesis

2.1 Theoretical Analysis:

The specific question that is trying to be answered is: Does personality have an effect on an individuals intertemporal choices? Given that someone's personality is something that is unique to them, as well as something that can be in common between people, I would suspect that there might be a relationship between personality and intertemporal choice. Imagine this example. Joe Brown and Frank White both commute from NJ to NYC for work every day and both choose to drive. One morning, there is abysmal traffic congestion, which will make both Joe and Frank late to work. Joe throws a huge fit, which wouldn't surprise people who know Joe (as he throws fits all the time), while Frank remains calm. Many people would attribute this difference to personality: Joe has a quick-tempered personality, while Frank has a calm personality. Given the

relationship between someone's natural tendencies and personality, hypothesizing that personality might affect intertemporal choice is well within reason. Finding out if personality has any impact on intertemporal choice will add to the bank of existing knowledge to be used for future research.

2.2 Methodology:

Data for this experiment was gathered through a survey distribution, primarily to current students at Pace University (in order to maximize survey responses). The survey contains fourteen questions: two questions based on intertemporal choice, one question regarding gender, one question regarding age, and ten questions which are taken from a personality quiz from a third party. The questions regarding intertemporal choice asked subjects to circle one of five choices, with each choice carrying a different value at a different point in time. It is important to note that these two questions will have similar traits. The first common trait is that the time distance between the answer choices will be the same in both questions. Secondly, each answer will have the same percentage increase in payoffs between each of the choices. For example, if there was a 10% increase from choice a to b in question 1, the answer choices in question 2 would increase 10% from a to b. There are a few differences between the two questions to note, however. Firstly, question 1 is formatted as a calendar date delay, and the second is formatted as a word delay (word delay meaning that delays are only stated using words). Secondly, the beginning values for each question are different: question 1 starts with an \$8 payoff, while question 2 starts with a \$10 payoff, and so forth. To be clear, the

possible choices that were dated later carried a larger payoff comparative to choices that were dated at an earlier time. Responses were collected via an online survey link, as well as some responses via paper (for those who did not receive the online survey link). Each answer choice to each question corresponds to a point value, which was then summed at the very end. Based on the amount of points that a subject receives, he or she fell into six different personality buckets. In order to give the reader a taste of how points measure to personality, examples of the two extremes will follow. Firstly, on the low end of the spectrum, under twenty-one points would show that, “people think you are shy, nervous, and indecisive, someone who needs looking after, who always wants someone else to make the decisions & who doesn't want to get involved with anyone or anything. They see you as a worrier who always sees problems that don't exist. Some people think you're boring. Only those who know you well know that you aren't”. On the high end of the spectrum, over sixty points would show that, “Others see you as someone they should ‘handle with care’ You're seen as vain, self-centered, and who is extremely dominant” Others may admire you, wishing they could be more like you, but don't always trust you, hesitating to become too deeply involved with you” (http://pastorpauley.com/counseling/personality_test.htm). All of the other buckets fall within these point ranges. I will also note that gender will be represented as a dummy variable, where an answer of 1 would indicate that the subject is female and an answer of 0 would indicate that the subject is male. Responses for surveys were collected and entered into an excel spreadsheet. A copy of the survey is included in the appendix section so a reader may become more familiar with its structure.

OLS regression is used in order to analyze the aforementioned data set, using STATA software. Given that this project is an attempt to investigate the possibility that a correlation between personality and intertemporal choice might exist, my dependent variable is the outcome (or payoff). Since my survey contains two different questions regarding intertemporal choice, I constructed two separate models, one for each of the questions. The independent variables is as follows: gender, age (1 if a college freshman, 2 if a college sophomore, 3 if a college junior, 4 if a college senior, and 5 if a college graduate), and the total amount of points an individual accrued based on their survey responses. It is important to note that total amount of points is used rather than individual personality buckets, as otherwise there would be six different dummy variables in the data set to represent personality at the same time. Given that the structure of the personality questions in the survey is to show the relationship of points to personality, using the raw score will not weaken the link between personality and points. This secures the position that using the point totals is a more appropriate approach. As described above, my model tries to explain that gender, grade, and most importantly personality, has an impact on one's desired payoff at a period in time. Additionally, I believe a linear form functional model would be best fit for this experiment. Due to the manageable size and the hypothesized relationship of my numbers, it would not be necessary to use a log form for any of the variables. Polynomial and inverse forms would be ruled out as well for other reasons that are not necessary to explain.

Given that the background for my models has been explained in the previous paragraphs, it is fitting that I describe the models themselves. For the first question concerning intertemporal choice, the model is as follows:

$$ITC1 = \beta_0 + \beta_1 Grade + \beta_2 Gender + \beta_3 Pbt + \epsilon$$

where “itc1” is the payoff desired (from the first question responses), “grade” is the grade that the respondent is in, “gender” is the gender of the respondent, and “pbt” is the total amount of points that the respondent accrued, and ϵ is the error term.

Similarly to the equation above, the model based off of the responses for the second question is this:

$$ITC2 = \beta_0 + \beta_1 Grade + \beta_2 Gender + \beta_3 PBT + \epsilon$$

where “ic2” is the payoff desired (from the second question responses), “grade” is the grade that the respondent is in, “gender” is the gender of the respondent, and “pbt” is the total amount of points that the respondent accrued, and ϵ is the error term.

2.3 Hypothesis

Overall, it is one’s hope that results are both in accordance to one’s hypotheses and that the results are significant. It is important to note that given the caliber of this experiment, comparative to the expected sample size, there is a possibility that the results will not be significant due to an issue with the sample size or sample bias. Therefore, if this is the case, this experiment and these results can be viewed as a preliminary study of this issue.

2.3.1 Hypothesis of Grade

I hypothesize that grade might have a smaller-scale effect on intertemporal choice that works alongside personality in the following way: As grade increases, especially when a person is a college graduate, they may be more inclined to choose a higher payoff. I believe this because a combination of a college education and work experience might allow for one to overcome the temptation of getting a lower short-run gain in order to receive a larger long-run gain.

2.3.2 Hypothesis of Gender

In terms of gender, I hypothesize that women will have a higher payoff in comparison to men. There have been many research studies done which have proven that women are more patient than men (in a wide variety of areas), so I predict that this would continue to hold in this experiment as well.

2.3.3 Hypothesis of Personality

Before I explain my hypothesis regarding personality, it is important to lay down a fundamental hypothesis that I am making regarding the point system. Using the explanation for the highest point bucket, I view this group as more present-gain oriented compared to the other buckets. As one moves down towards the bottom, they progressively get less self-present oriented. I hypothesize this based off of real life experience: people I know who would fall into the highest bucket, racking up the most points, tend to be impatient, while those who are lower on the spectrum are not as impatient in comparison.

Therefore, given my belief stated above, I predict that as someone's total point value increases, the payoff associated with said person would be smaller, and I expect this to be true on both models. Accordingly, the expected sign of the coefficient for "pbt" would be negative.

3 Results

Out of 209 responses, 5 were not completely filled out, and therefore were discarded. Given that point total would therefore be inaccurate because of unanswered questions, I did not include this information in the data set: the total amount of observations was 204. According to Table 2 below, one can observe the summary statistics for this experiment. Firstly, the means for both "itc1" and "itc2" lie in between the third and fourth answer choices of each question. Secondly, the mean for "grade" was 3.09, which shows that the mean grade was a junior. The frequency distribution shown in Table 2 illustrates that a little under half of the subjects were either a senior or graduate. Thirdly, given that the mean for gender was about .63, there was a larger amount of female subjects who completed the survey. Last but not least, the range of "pbt" illustrates that subjects fell within the middle-four personality buckets, with a tendency to be located around the fourth bucket, on average.

. summarize

Variable	Obs	Mean	Std. Dev.	Min	Max
itc1	204	84.89706	61.59933	8	140
itc2	204	102.6593	71.803	10	165
grade	204	3.093137	1.405882	1	5
gender	204	.627451	.4846728	0	1
pbt	204	42.69118	4.989419	30	54

Table 1

. tabulate grade

GRADE	Freq.	Percent	Cum.
1	41	20.10	20.10
2	33	16.18	36.27
3	32	15.69	51.96
.	98	48.03	100.00
Total	204	100.00	

Table 1

3.1 Analysis of Regression, Model 1

According to Table 3, the results of this regression were weak. The R-squared was a meager .0011, meaning that .11% of the data can be explained with my model. The Adjusted R-squared was at the same level, effectively 0%.

Furthermore, the higher root MSE value is another indicator that this model is not too accurate in terms of explaining the collected data.

Furthermore, none of the coefficients were significant, rather, seemingly far off. Out of the significance of these coefficients, “grade” seemed to be the least significant, with a t-value of 0.09 and a p-value of 0.930. “Pbt”, the main focus of this experiment, was the most significant (out of all of the insignificant value) at a 0.37 t-value, and a 0.7111 p-value. Given the very low values of the t-values, it proves unnecessary to perform a t-test to test for the significance of the coefficient: the t-values of all variables would be much lower than the critical t-value and the p-values are way higher than the 5% significance level.

```
. regress itc1 grade gender pbt
```

Source	SS	df	MS			
Model	837.460535	3	279.153512	Number of obs =	204	
Residual	769441.378	200	3847.20689	F(3, 200) =	0.07	
Total	770278.838	203	3794.47704	Prob > F =	0.9746	
				R-squared =	0.0011	
				Adj R-squared =	-0.0139	
				Root MSE =	62.026	

itc1	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
grade	.2776935	3.157278	0.09	0.930	-5.948132	6.503519
gender	-2.668092	9.218656	-0.29	0.773	-20.84632	15.51014
pbt	-.3333983	.8977591	-0.37	0.711	-2.103686	1.43689
_cons	99.94538	42.87015	2.33	0.021	15.40989	184.4809

Table 3

In terms of coefficient signs, the coefficient for “grade” was positive, indicating that as someone’s grade increased, his or her payoff would increase as well. Also, the coefficient for “gender” was negative, which indicates that when someone was a woman, the expected payoff decreased.

Lastly, the negative coefficient for “pbt” indicates that as the point total increases, expected payoff would decrease. All of these reveal that my hypothesis was correct, aside from the “gender” coefficient: I had predicted that men would tend to discount more than women; however, in this model this was not the case.

```
. hettest
```

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity  
Ho: Constant variance  
Variables: fitted values of itc1  
  
chi2(1)      =      0.08  
Prob > chi2  =      0.7725
```

Table 4

Table 4 illustrates the heteroskedasticity test for this model. As evidenced by the heteroskedasticity test result, it is evident that this model does not suffer from heteroskedasticity. This is because of the low Chi-squared value generated, and the high Prob>Chi-squared result.

The results for this model are both surprising and somewhat comforting to say the least. They are surprising in the sense that these results were not as

significant as I was expecting, as well as the fact that gender played an opposite role than I expected. The comfort is in the fact that my hypotheses about “grade” and “pbt” were correct.

3.2 Analysis of Regression, Model 2

The regression of the second model yielded somewhat similar results. As can be seen in Table 5, R-squared was barely higher than in model 1, at .0054. This means that only .54% of the data can be explained by the model. Adjusted R-squared was virtually 0% as well, and root MSE was higher than in model 1. Therefore, in terms of overall significance, model 2 is no better than model 1.

In terms of the significance of the coefficients, values for every coefficient were higher than in model 1, although still insignificant. The lowest t-value was, again, “grade” at -0.16, and the highest was “pbt” at -0.66 with p-values of 0.873 and 0.507, respectively. As with model 1, due to the low value of the t-values, it is unnecessary to perform t-tests as the t-critical will be larger than the reported t-value.

. reg itc2 grade gender pbt

Source	SS	df	MS			
Model	5703.07295	3	1901.02432	Number of obs =	204	
Residual	1040898	200	5204.49	F(3, 200) =	0.37	
Total	1046601.07	203	5155.67031	Prob > F =	0.7782	
				R-squared =	0.0054	
				Adj R-squared =	-0.0095	
				Root MSE =	72.142	

itc2	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
grade	-.5861581	3.672224	-0.16	0.873	-7.827403	6.655087
gender	6.97885	10.7222	0.65	0.516	-14.16422	28.12192
pbt	-.6936455	1.044182	-0.66	0.507	-2.752664	1.365373
_cons	129.706	49.86219	2.60	0.010	31.38298	228.0291

Table 5

In terms of the signs of coefficient values, this model produces very drastically different results, besides the coefficient sign for “pbt”, which was negative in both models, and, about twice the size in this model compared to the first. The coefficient for “grade” changed from a negative sign in model 1 to a positive sign in this model, and more than doubled in value as well. In this model, being female does not decrease expected payoff as it did in model 1, but rather increases it.

In addition, the sign for grade completely reversed as well from a positive in the last model to a negative value in this model. This would mean that in this case, the increase in someone’s grade decreases the expected payoff. Again, I am faced with a two-to-one split regarding my proposed hypothesis, but this time with a different situation. I predicted that an increase in “grade” would increase expected

payoff, yet in this model it does not. Secondly, I predicted that women would be less likely to discount the payoffs, and therefore have an overall higher expected payoff. In the last model I had to accept that my hypothesis did not hold, however, it does in this model.

```
. hettest
```

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity  
Ho: Constant variance  
Variables: fitted values of itc2  
  
chi2(1)      =      0.00  
Prob > chi2  =      0.9733
```

Table 6

Table 6 above shows that this model does not suffer from heteroskedasticity, as the Chi-squared is effectively 0, and the Prob>Chi-squared is high at 0.9733. Compared to the first model, this is more-strongly homoskedastic, however, the importance lies with the fact that neither model suffers from heteroskedasticity.

3.3 Relating the Two Models

The results from model 2's regression were drastically different in terms of coefficient signs and meanings, and lead to some puzzling questions; a reason must exist to explain why the models differed as drastically as they did. The most difficult question to answer is as follows: Why were there changes in coefficient signs?

In their experiment, and as mentioned earlier in this paper, Read et al. (2005) discovered a new anomaly in temporal discounting: “discount rates that are imputed when time is described using calendar dates are markedly lower than those revealed when future outcomes are described in terms of the corresponding delay.” In other words, people tended to discount future outcomes more if they were laid out in a word format. Now, remember a difference between question 1 and question 2 in the survey: one question was based around a calendar date format, while the other was based off of a word format (question 1 was the calendar date and question 2 was the word format). Given the results of my own experiment, it seemed as though “grade” was impacted by the change of format; however, “gender” was not. This raises major implications for the “date/delay effect”, the name that Read et al. (2005) have dubbed for this anomaly. It appears as though women are excluded from this effect. As it turns out, out of 26 women who changed their respective choices from question 1 to question 2, 15 of them chose a higher payoff rather than the 11 who chose lower. Clearly, when asked questions in word format rather than a calendar format, women seem to tend to increase their expected payoffs, not discount them more.

Using these grounds in the previous paragraph, we could allude to the fact that both “grade” and “pbt” were affected by the date/delay effect, as their coefficient sign turned negative if it wasn't already (the case for “gender”) while the value of the coefficient increased. Discounting of payoffs seem to increase in both “grade” and “pbt” as word format is introduced, which conforms to the theory presented in Read et al. (2005).

Providing that personality is the main focus of this paper, the results of the regression are something worth explaining in further detail. As mentioned earlier, the t-values for “pbt” in both experiments were low, and therefore statistically insignificant. In terms of the coefficient signs for pbt, the negative value indicates that there is a negative correlation to expected payoff as the total point value increases for an individual. Therefore, the more present-gain someone is as defined by personality, the more he or she would discount a payoff.

The reasons for explaining why the model, as well as the individual coefficients, were statistically insignificant is two-fold: it can either be attributed to issues with the experiment, or to the theory that personality does not, in fact, affect someone’s expected payoff. Given the design of this experiment, there could have been fundamental issues that affected the results. First, and most importantly, I believe the number of observations was too low in order to accurately account for a normal distribution. Furthermore, given that this experiment was completed at an undergraduate institution, the vast majority of participants in the survey were from the university: a sample bias might have played a role in these results. Also, given that the overwhelming majority of university students do not currently, or have not had (for a longer period of time) a full-time job, some values that constituted as payoffs might have seem inflated. In other words, a payoff of \$140 might have appeared as a much larger sum of money to an undergrad without a full-time job. If this bias were present, it would definitively have implications on the data used in the experiment.

It is also reasonable to possibly conclude that these models might have suffered from omitted variable bias. With only three dependent variables, it is hard to think that these are the only three factors that would affect the expected payoff. Omitting variables that would be important in these models have immeasurable effect, in the sense that it cannot be determined if the effects will be very grand or minimal. Some examples of other variables that could have (and most likely should have) been included are the following: a scale to measure a person's risk aversion, their current major in university (if they are still a student) or what their major was when they attended university, and if the subject currently has investments, and if so, what type (stocks, bonds, etc.).

Another approach to the interpreting the results is the theory that personality does not affect someone's intertemporal choices. By the coefficient not being significant, it would illustrate that people choose a specific payoff at a specific point in time for reasons other than personality. In order to confirm that this is the proper approach, one would have to duplicate this experiment, and use a much larger sample size (among other things). If the coefficient would still remain insignificant, it would more strongly affirm that someone's personality does not affect intertemporal choices.

4 Conclusion and Recommendations

4.1 Conclusion

The study of intertemporal choice is complicated and vast. Personality, theoretically, should play a role in affecting intertemporal choices, as personality is tasked with describing how someone truly is. Therefore, probing for a statistical relationship between these is well within a scope of rationality.

To recap, the main purpose of this paper was to attempt to prove that a correlation between personality and intertemporal choice exists. Although both of the full models are not statistically significant, there are many implications of the results.

One implication is through the role of the coefficient signs. As hypothesized, and occurring in both models, the coefficient on “pbt” was negative, suggesting that as the total point value increases, this would suggest that someone is more present-gain oriented, and has a higher discount rate. Using the scale of reference in the survey, the higher the point total the more vain someone is. Therefore, as vainness increases in a person, so does said person’s discount rate. Furthermore, the coefficient signs for both “gender” and “grade” reversed in model 2 compared with model 1. The only main structural difference between the two questions was their format: the question for model 1 was formatted as a calendar date, while the question for model 2 was formatted as a word structure. Using the theory of the “date/delay effect” in Read et al. (2005), it is evident that this effect affected the “grade” variable (as its coefficient sign switched to negative), while the “gender” coefficient changed

from a negative sign to a positive sign with the change of format. Therefore, it appears as if women tend to discount less when faced with payoffs in a word format, the opposite of what Read et al. (2005) claimed the “date/delay effect” would do. This is interesting, as it seems to put many other research findings in question. As previously mentioned, many findings have suggested that women tend to have a smaller discounting rate, showing the tendency that they are willing to wait longer for a higher payoff compared with men. However, given the change in the coefficient sign between the two models, it appears that this prediction does not hold in this experiment. This could have many implications on past and future research, as the formatting of the questions might play a much larger role than was previously imagined.

Overall, the results of this experiment reveal many anomalies about intertemporal discounting, and more widely, the field of behavioral economics. This paper serves as a preliminary study, in order to pave the way for a more (hopefully) successful replication. In addition to providing a basis for replication, this paper also highlighted the aforementioned anomalies, which should be taken into consideration when doing further research in this field. It would also be interesting to see if repeating past experiments while taking some of the factors of this experiment into consideration would change the results. As the great Albert Einstein once said, “If you can’t explain it simply, you don’t understand it well enough.” Even though we currently understand a sufficient amount about the nature of intertemporal choice, we are far away from grasping it fully. It is only through replications of studies to affirm our findings, and through the application of new ideas and theories will we

come to understand more about this topic as an academic community. For all we know, there might not be a way to explain it simply, or there might, in fact, be no way to predict people's choices at all.

4.2 Recommendations

If this experiment were to be replicated, there are some changes that could be made to make it more effective and accurate. The first change would be to drastically increase the sample size, and to increase the scope of subjects. As is, 204 observations, mainly from students at a university, are not sufficient enough to represent a normal distribution: sample bias might be in order. Therefore, adding a much larger amount of observations, and comparing those results with those of this experiment would solve this issue. If the results now indicated that the coefficients were statistically significant, in addition to the model being a strong fit, one could come to the conclusion that personality, along with gender and grade, do play a role in someone's intertemporal choice. However, if the results still indicated that there was no statistical significance in the model or any of the coefficients, it would be hard to argue that personality plays a role in someone's intertemporal choices (assuming that there would be no other errors that would invalidate the results).

Additionally, adding variables, as well as making some questions more specific would help as well. One example of this would be to substitute a grade in university with different age buckets, or solely using a number value for age. By doing this, the researcher could possibly address a fundamental issue with the

method of collecting age in this experiment. This is just one example of adding a variable, but there are many other variables that could play a pivotal role in improving the overall quality of these models.

Furthermore, another approach to possibly take is to make the payoffs realistic for subjects. In other words, test subjects would receive a check for whatever choice they made (at whatever date that payoff would correspond to). Making the payoffs real for test subjects is very popular among experiments concerning intertemporal choice. This is because researchers believe that someone's true decision will emerge if they are realistically inserted into the situation, rather than just answering without consequence. One way to test if there is a difference would be to question the same group of people in two different experiments, one via a paper survey with no real payout, and another with a real payout. We look forward to further research of the topic to clarify the relationship between personality and the time preference pay out.

Appendix

Survey

1. Which option would you prefer? (Reference point for start date would be today)

- a) \$8 now
- b) \$12 on 12-31-2014
- c) \$49 on 11-4-2015
- d) \$110 on 1-27-16
- e) \$140 on 3-15-16

2. Are you Male or Female? (Circle One).

3. Are you a Freshman, Sophomore, Junior, Senior, or a College Graduate? (Circle One).

4. When do you feel your best?

- a) in the morning
- b) during the afternoon & and early evening
- c) late at night

5. You usually walk

- a) fairly fast, with long steps
- b) fairly fast, with little steps
- c) less fast head up, looking the world in the face
- d) less fast, head down
- e) very slowly

6. When talking to people you

- a) stand with your arms folded
- b) have your hands clasped
- c) have one or both your hands on your hips
- d) touch or push the person to whom you are talking
- e) play with your ear, touch your chin, or smooth your hair

7. When relaxing, you sit with

- a) your knees bent with your legs neatly side by side
- b) your legs crossed
- c) your legs stretched out or straight
- d) one leg curled under you

8. When something really amuses you, you react with

- a) a big, appreciative laugh
- b) a laugh, but not a loud one
- c) a quiet chuckle
- d) a sheepish smile

9. When you go to a party or social gathering; Do you...

- a) make a loud entrance so everyone notices you
- b) make a quiet entrance, looking around for someone you know
- c) make the quietest entrance, trying to stay unnoticed

10. You're working very hard, concentrating hard, and you're interrupted; Do you...

- a) welcome the break
- b) feel extremely irritated
- c) vary between these two extremes

11. Which of the following colors do you like most?

- a) red or orange
- b) black
- c) yellow or light blue
- d) green
- e) dark blue or purple
- f) white
- g) brown or gray

12. When you are in bed at night, in those last few moments before going to sleep, you lie

- a) stretched out on your back
- b) stretched out face down on your stomach
- c) on your side, slightly curled
- d) with your head on one arm
- e) with your head under the covers

13. You often dream that you are

- a) falling
- b) fighting or struggling
- c) searching for something or somebody
- d) flying or floating
- e) you usually have dreamless sleep
- f) your dreams are always pleasant

14. Which option would you prefer?

- a) \$10.00 now
- b) \$15.00 two and a half months from now
- c) \$51.25 a year from now
- d) \$127.50 a year and four months from now
- e) \$165.00 a year and a half from now

Point System and Personality Buckets

It is important to note that number 1-10 does not correlate to questions 1-10 in the survey above, but rather the ten questions about personality. In the survey above, they are questions*

POINTS:

1. (a) 2 (b) 4 (c) 6
2. (a) 6 (b) 4 (c) 7 (d) 2 (e) 1
3. (a) 4 (b) 2 (c) 5 (d) 7 (e) 6
4. (a) 4 (b) 6 (c) 2 (d) 1
5. (a) 6 (b) 4 (c) 3 (d) 5 (e) 2
6. (a) 6 (b) 4 (c) 2
7. (a) 6 (b) 2 (c) 4
8. (a) 6 (b) 7 (c) 5 (d) 4 (e) 3 (f) 2 (g) 1
9. (a) 7 (b) 6 (c) 4 (d) 2 (e) 1
10. (a) 4 (b) 2 (c) 3 (d) 5 (e) 6 (f) 1

Now add up the total number of points.

OVER 60 POINTS: Others see you as someone they should "handle with care" You're seen as vain, self-centered, and who is extremely dominant. Others may admire you, wishing they could be more like you, but don't always trust you, hesitating to become too deeply involved with you.

51 TO 60 POINTS: Others see you as an exciting, highly volatile, rather impulsive personality; a natural leader, who's quick to make decisions, though not always the right ones. They see you as bold and adventuresome, someone who will try anything once; someone who takes chances and enjoys an adventure. They enjoy being in your company because of the excitement you radiate.

41 TO 50 POINTS: Others see you as fresh, lively, charming, amusing, practical, and always interesting; someone who's constantly in the center of attention, but sufficiently well-balanced not to let it go to their head. They also see you as kind, considerate, and understanding; someone who'll always cheer them up and help them out.

31 TO 40 POINTS: Others see you as sensible, cautious, careful & practical. They see you as clever, gifted, or talented, but modest ... Not a person who makes friends too quickly or easily, but someone who's extremely loyal to friends you do make and who expect the same loyalty in return. Those who really get to know you realize it takes a lot to shake your trust in your friends, but equally that it takes you a long time to get over it if that trust is ever broken.

21 TO 30 POINTS: Your friends see you as painstaking and fussy. They see you as very cautious, extremely careful, a slow and steady plodder. It'd really surprise them if you ever did something impulsively or on the spur of the moment, expecting you to examine everything carefully from every angle and then, usually decide against it. They think this reaction is caused

partly by your careful nature.

UNDER 21 POINTS: People think you are shy, nervous, and indecisive, someone who needs looking after, who always wants someone else to make the decisions & who doesn't want to get involved with anyone or anything. They see you as a worrier who always sees problems that don't exist. Some people think you're boring. Only those who know you well know that you aren't.

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