

**Quest University**

**Religious people do not discount the future  
less**

Assignment  
in  
Data Science A

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## Abstract

Hello my name is Samuel. I am from Germany and I attend

# 1 Introduction & Methods

Introduction (3/4 page), Methods (1 page), Results (2 pages) and Discussion (3/4 pages) sections

introduction: intertemporal choice experiment delay gratification has several beneficial outcomes

Delay gratification could be encouraged by religion as many religions emphasize future rewards instead of immediate gratification such as reincarnation, resurrection and immortality (Carter et al. 2012). Furthermore patience has an important role in many religions (Carter et al. 2012). Socialization in a religious environment might therefore lead to a more patient behavior resulting in a preference for a higher later reward instead of an instant gratification (Carter et al. 2012).

In line with the economic literature the trade-off between instant and delay gratification can be modeled through an intertemporal choice experiment. In an intertemporal choice experiment participants have to decide between an amount  $x$  now and a higher amount  $x + y$  later, where  $y$  is a positive number.

To my knowledge three papers have investigated the relationship between religion and future discounting so far.

Carter et al. (2012) found that religious people discount have a stronger preference for later reward as their non-religious counterparts and therefore discount future rewards less. Controversial, neither Thornton, Stokes, and Helms (2015) nor Benjamin, Choi, and Fisher (2010) observed a significant relationship between religion and discounting of future rewards.

Based on the controversial findings as well as the scarcity of the previous research more research is needed to clarify the relationship between religion and discounting of future rewards.

Beside this, all three studies have major drawbacks. Carter et al. (2012) and Benjamin, Choi, and Fisher (2010) use undergraduate students from the United States as their participants. According to Henrich, Heine, and Norenzayan (2010) undergraduate students from "Western, Educated, Industrialized, Rich and Democratic" (WEIRD) societies - especially from the USA - are the least representative samples which substantially limit the generalization of their findings. Thornton, Stokes, and Helms (2015) take this

drawback into consideration and recruited their participants on the online labour market M-Turk. Even though, participants from M-Turk are a more representative sample than undergraduates they are not a representative sample since people who work online are - as well as undergraduates - just a small fraction of the whole population (Horton, Rand, and Zeckhauser 2011). Additionally, all three studies either do not control or just control for very few variables which could have an influence on future discounting.

Based on these drawbacks this study uses a representative sample of the German population to investigate the relationship between future discounting and religion and controls for several variables that are associated with future discounting. Based on the existing literature the research question for the following paper is:

**Hypothese 1:** *Religious people discount the future less than non-religious people and have therefore a stronger preference for later rewards as non-religious participants*

## 1.1 Sample

The sample consist of a cross section of the German population.<sup>1</sup> To measure future discounting each participant took part in an intertemporal choice experiment. For this purpose each participant received a intertemporal choice matrix witch 20 rows.<sup>2</sup> For each row the participant had to decide between 100 euros "today" or a higher amount of  $Y$  in 12 months (Dohmen et al. 2010). For all rows the early payment was 100 euros but the future payment increased by each the subsequent row.

The first time that a participant switched from the early payment to the later payment shows to which extent the participant discounts future rewards, indicated by the internal rate of return.<sup>3</sup> For participants who never switch from the early payment to the later one, a switching row of 21 is assumed.

## 1.2 variables that I use

The response variable is the switching row, which indicates how strong a participant discounts future rewards. A higher switching row indicates that the participant discounts future payments stronger. The explanatory variable is the religious affiliation of a participant. Religious affiliation is coded as a dummy variable with 1 when the participant

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<sup>1</sup>For a detailed description of the data collection see Dohmen et al. (2010)

<sup>2</sup>The intertemporal choice matrix can be found in the appendix

<sup>3</sup>some more information to internal rate of return

belongs to a religious community and with 0 if this is not the case.

Control variables are extracted from the existing literature and are displayed in following table.<sup>4</sup>

Table 1: Control variables

Gender	1 = male and 0 = female
Age	age in years
Cognitive ability	
High-school degree	1 = high-school degree and 0 = no high-school degree
Secondary school	1 = secondary school degree and 0 = no secondary school degree
Enrolled	1 = still enrolled and 0 = not enrolled
Without degree	1 = without degree and 0 = degree
Income	log income
Credit constraint	1 = Credit constraint and 0 = no credit constraint
Big Five	Openness to experience, Conscientiousness, Extraversion, Agreeableness, Neuroticism

### 1.3 Methods

In a first step the data is visualized to get an overview and observe whether the response variable switching row is normally distributed. Checking the normality provides the basis which statistical tests can be applied. In a second step a Welch two-sample t-test is applied to compare the means of switching row between religious and non-religious people. A Welch two-sample t-test is appropriate as switching row is approximately normally distributed.<sup>5</sup> Although a Welch t-test is sufficient a nonparametric test (Wilcoxon-Mann-Whitney test) is conducted to verify the previous results. To investigate whether there is linear relationship between religion and switching row a Spearman rank task is conducted.

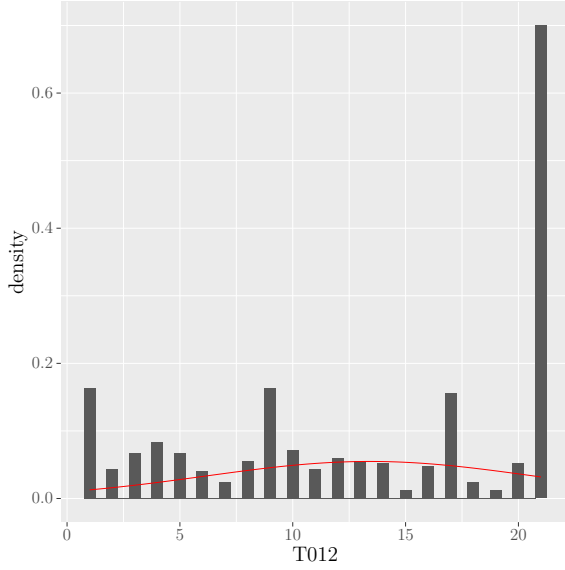
In a third step a linear regression model is fitted to the data. This allows to control for several variables that may have an influence on intertemporal decision making and detect whether religion still has an influence on the switching row when controlling for all this variables.

Finally an analysis of variance (ANOVA) is performed to compare two regression models and decide whether the model with more variables fits the data better than the model with less variables.

Throughout the paper I use a significance level of alpha 10 % which allows to observe significant results that would not be significant at the conventional 5 % significance level.

<sup>4</sup>For exact coding of the control variables can be found in the R-script

<sup>5</sup>Why see results section



For the interpretation of the linear regression I will just interpret statistically significant estimators and the *ceteris paribus* clause pertains for the analysis and is not mentioned again.

## 2 Results

53.8 % of the participants are female and 46.2 % are male with a mean of age of 46 (range: 14 - 90). Participants belong to a wide range of religious communities (Protestant: 34.8%, Catholic: 31.4 %, member of a different Christian denomination or religious community: 2.6%, Islamic: 2.2%, another religious community: 0.2%, no religious community: 28.8%)

### 2.1 Visualizing the data

Visualizing the data with a histogram and a QQplot shows that switching row might not be normally distributed. a lot of observations on the very right A Shapiro-Wilk normality test supports this impression of a non normal distribution (p-value < 0.0001).

Applying various transformation to the the variable switching row does not result in a normal distributed variable. Therefore, I refrain from transforming the variable.

According the the Central Limit Theorem (CLT) samples with sample size > 50 are approximately normal distributed and therefore parametric tests are suitable. As the data set has a sample size of 500 observations parametric test can be applied.

mean switching row 13.42 (sd = 7.28) correspond to a mean return of 33.56 (sd = 18.19)

## 2.2 Descriptive Statistic

what I want to do

what is the mean for the switching row of religious people and not religious people?

compare the means Welch Two Sample t-test shows that means of switching row religious and non-religious people are significantly different and that religious people have a higher switching row than their non religious counterparts (p-value: 0.066).

confidence interval

Wilcoxon-Mann-Whitney test supports these results indicating that the switching row of religious participants is likely shifted left or right with respect to switching row of the non-religious participants (p-value: 0.081).

compare the variances?

correlation The (linear) correlation between switching row and religion is 0.078 (spearman; p-value: 0.08) indicating.

## 3 Regression

linear regression with one variable

The intercept of the first regression model indicates the expected switching row for the non-religious participants is 12.45(p-value< 0.0001).

The estimator for the dummy variable religion shows that that the expected switching row for religious participants is 1.36 higher than the switching row of non-religious participants (p-value: 0.058).

Model fits the data F-test p-value: 0.058 The F-test shows that the model is fits the data since the estimator religion is different from zero (p-value: 0.058)

The adjusted  $R^2$  implies that the model explains 0.05% of the variance of switching row. The remaining 99.5% of the variance are still unexplained.

linear regression with all variables The second model controls for all the variables that might additionally have an influence on the switching row.

intercept: The intercept is 27.14 and is statistical (p-value < 0.0001) but not economical significant as the maximum switching row in the experiment is 21.

The estimator religion shows that the expected switching row for religious participants is 1.69 lower than the expected switching row for non-religious participants (p-value: 0.056).  
logincome if we increase income by 10 percent the switching row decreases by 0.2048635 (p-value: 0.002)

abi Participants that have a high-school degree have an expected switching row that is 1.827 lower than the switching row for participants that do not have a high-school degree (p-value: 0.094).

The F-test indicates that the model fits the data since at least one of the coefficients is nonzero (p-value: 0.059). 3.3% of the variance in switching row in explained by the model but the remaining 96.7% are still unexplained.

comparison of the two models through anova have to adjust the two rows Comparing the two models with an analysis of variance (ANOVA) shows that that we should keep the additional variables in the model as they reduce the sum of squared residuals by 1658.4 and the two models are therefore significantly different (p-value: 0.055).

## 4 Discussion

Table 2: Pay-off matrix for intertemporal choice experiment

	today	or	in 12 months
1	100.00		102.50
2	100.00		105.10
3	100.00		107.60
4	100.00		110.20
5	100.00		112.80
6	100.00		115.50
7	100.00		118.20
8	100.00		121.00
9	100.00		123.70
10	100.00		126.50
11	100.00		129.30
12	100.00		132.20
13	100.00		135.10
14	100.00		138.00
15	100.00		141.00
16	100.00		144.00
17	100.00		147.00
18	100.00		150.00
19	100.00		153.10
20	100.00		156.20

goal: Monday everything is ready