

# Code: Analysis of messaging and financing on demand for non-traditional cookstove adoption in Uganda

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## 1. Variables

### 1.1. Clean the data

### 1.2. Select Variables

#### (1) Fixed Effect Variables - TBD

DATESURVEY  
UNIQUE\_HHID  
PARISH

#### (2) Household socio-economic and demographic variables - H

We ignore *gatherwood or buywood last month* due to possible error in memory and low impact from a past event.

1. FEMALE - gender(6 missing)
2. AGE - age(6 missing)
3. MARRIED - marital status(0 missing)
4. WIFECOOK - whether the wife is the primary cook(0 missing)
5. JOINTDECISION - whether husband and wife make decisions jointly(0 missing)
6. KNOWLUNCH\_Dummy - Respondent knows how many people ate lunch
7. LUNCHYESTERDAY - How many ate lunch at HH yesterday (*252 missing*)
8. TYPICALNUMEATING\_Dummy - Was Yesterday Lunch Typical (*252 missing*)
9. HOWPAID (*285 missing, ignored in regression*, as almost all the people paid in cash, we do not estimate the impact of paying in cash due to the extreme imbalance in different types of payment.)

#### (3) Wealth variables - W

We ignore SPOUSE phone since there are 473 missing values (about 20% of whole data set).

1. HH\_PHONES - Count of phones owned by household(0 missing)

2. INCOME\_Dummy - Earns income(6 missing)
3. BICYCLE\_DUMMY(4 missing), CAR\_DUMMY(4 missing), MOTORCYCLE\_DUMMY(4 missing)
4. RADIO\_DUMMY(6 missing)
5. SELFEMPLOYED(*290 missing*)
6. TIME\_EMPLOYED(*291 missing*)
7. COWS\_Dummy(6 missing)
8. TV\_Dummy(7 missing)
9. Total\_Asset - this is computed with all the wealth dummies and durable good prices provided.

#### **(4) Cookstove variables - C**

1. WOOD - the dummy of whether wood is the primary fuel(0 missing)
2. TSF\_PRIMARY - whether a three-stone fire is the primary stove. None means owning a stone stove(6 missing)
3. BUYWOOD\_DUMMY - buys wood last week or month(6 missing)
4. GATHERWOOD\_DUMMY - whether the household gathered wood last week(6 missing)
5. STOVE1 - Type of stove already owned

#### **(5) Dependent variables - Y**

1. MAXBID
2. MAXBIDNOVEL

#### **(6) Gender interaction variables**

Female\_AGE  
 Female\_MARRIED  
 Female\_WIFECOOK  
 Female\_JOINTDECISION  
 Female\_KNOWLUNCH\_Dummy  
 Female\_LUNCHYESTERDAY  
 Female\_HH\_PHONES  
 Female\_INCOME\_Dummy  
 Female\_MOTORCYCLE\_DUMMY  
 Female\_CAR\_DUMMY  
 Female\_RADIO\_DUMMY  
 Female\_COWS\_Dummy  
 Female\_TV\_Dummy  
 Female\_WOOD  
 Female\_TSF\_PRIMARY  
 Female\_BUYWOOD\_DUMMY  
 Female\_GATHERWOOD\_DUMMY

### 1.3. Overview of auctions - Table 1

HH received messages and reported is 2234. Payment type recorded is 2018

```
## Toal HH amount
length(Fulldata$HHID)

## [1] 2303

## HH's that took Demand Determinant Survey
length(Data$DATESURVEY)

## [1] 2234

## HH's that bid on Pay Within a Week Auction - number of wining
# 2125
sum(Data$WIN_TRADITIONAL_OFFER, na.rm=T)

## [1] 47

## HH's that bid on time payment - number of wining
# 2135
sum(Data$WIN_NOVEL_OFFER, na.rm=T)

## [1] 45

## HH's are female
sum(Fulldata$FEMALE,na.rm = T)

## [1] 1617

mean(Fulldata$MAXBID, na.rm=T)

## [1] 4.858061

sd(Fulldata$MAXBID, na.rm=T)

## [1] 4.650002

t.test(Fulldata$MAXBID)

## 
## One Sample t-test
##
## data: Fulldata$MAXBID
## t = 48.16, df = 2124, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 4.660241 5.055881
## sample estimates:
## mean of x
## 4.858061
```

```

median(Fulldata$MAXBID, na.rm=T)

## [1] 3.976143

mean(Fulldata$MAXBIDNOVEL, na.rm=T)

## [1] 6.830965

sd(Fulldata$MAXBIDNOVEL, na.rm=T)

## [1] 6.384978

t.test(Fulldata$MAXBIDNOVEL)

##
## One Sample t-test
##
## data: Fulldata$MAXBIDNOVEL
## t = 49.434, df = 2134, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 6.559974 7.101957
## sample estimates:
## mean of x
## 6.830965

median(Fulldata$MAXBIDNOVEL, na.rm=T)

## [1] 4.771372

```

For tradition bids

```

# Winning bids
tradition = Fulldata[which(Fulldata$WIN_TRADITIONAL_OFFER== 1), ]
length(tradition$WINNING_AMOUNT)-sum(is.na(tradition$WINNING_AMOUNT))

## [1] 47

mean(tradition$WINNING_AMOUNT)

## [1] 12.86748

sd(tradition$WINNING_AMOUNT)

## [1] 5.073302

```

```

t.test(tradition$WINNING_AMOUNT)

##
##  One Sample t-test
##
## data: tradition$WINNING_AMOUNT
## t = 17.388, df = 46, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 11.37790 14.35705
## sample estimates:
## mean of x
## 12.86748

median(tradition$WINNING_AMOUNT)

## [1] 11.92843

# Second price paid
47 -sum(is.na(tradition$PAID_PRICE))

## [1] 38

mean(tradition$PAID_PRICE,na.rm = T)

## [1] 13.35147

sd(tradition$PAID_PRICE,na.rm = T)

## [1] 5.163305

t.test(tradition$PAID_PRICE)

##
##  One Sample t-test
##
## data: tradition$PAID_PRICE
## t = 15.94, df = 37, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 11.65433 15.04861
## sample estimates:
## mean of x
## 13.35147

median(tradition$PAID_PRICE,na.rm = T)

## [1] 11.92843

```

```

# Deposit paid for stove
47 -sum(is.na(tradition$DEPOSIT_ON_SALES_DAY))

## [1] 47

mean(tradition$DEPOSIT_ON_SALES_DAY)

## [1] 5.6089

sd(tradition$DEPOSIT_ON_SALES_DAY)

## [1] 4.367847

t.test(tradition$DEPOSIT_ON_SALES_DAY)

##
## One Sample t-test
##
## data: tradition$DEPOSIT_ON_SALES_DAY
## t = 8.8036, df = 46, p-value = 1.991e-11
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 4.326452 6.891348
## sample estimates:
## mean of x
##      5.6089

median(tradition$DEPOSIT_ON_SALES_DAY)

## [1] 3.976143

# Stoves returned
sum(tradition$PAID_IN_FULL)

## [1] 18

sum(tradition$RETURNED)

## [1] 4

sum(tradition$DEFAULT)

## [1] 2

sum(tradition$PAYMENT_COMPLETE)

## [1] 41

```

For time payment

```

timepay = Fulldata[which(Fulldata$WIN_NOVEL_OFFER== 1), ]
length(timepay$WINNING_AMOUNT)-sum(is.na(timepay$WINNING_AMOUNT))

## [1] 45

mean(timepay$WINNING_AMOUNT)

## [1] 16.77932

sd(timepay$WINNING_AMOUNT)

## [1] 6.375708

t.test(timepay$WINNING_AMOUNT)

##
## One Sample t-test
##
## data: timepay$WINNING_AMOUNT
## t = 17.654, df = 44, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 14.86385 18.69480
## sample estimates:
## mean of x
## 16.77932

median(timepay$WINNING_AMOUNT)

## [1] 15.90457

45 -sum(is.na(timepay$PAID_PRICE))

## [1] 35

mean(timepay$PAID_PRICE,na.rm = T)

## [1] 17.04061

sd(timepay$PAID_PRICE,na.rm = T)

## [1] 6.492162

t.test(timepay$PAID_PRICE)

```

```

##  

##  One Sample t-test  

##  

## data: timipay$PAID_PRICE  

## t = 15.529, df = 34, p-value < 2.2e-16  

## alternative hypothesis: true mean is not equal to 0  

## 95 percent confidence interval:  

## 14.81048 19.27075  

## sample estimates:  

## mean of x  

## 17.04061

median(timipay$PAID_PRICE,na.rm = T)

## [1] 15.90457

45 -sum(is.na(timipay$DEPOSIT_ON_SALES_DAY))

## [1] 45

mean(timipay$DEPOSIT_ON_SALES_DAY)

## [1] 5.058538

sd(timipay$DEPOSIT_ON_SALES_DAY)

## [1] 2.772161

t.test(timipay$DEPOSIT_ON_SALES_DAY)

##  

##  One Sample t-test  

##  

## data: timipay$DEPOSIT_ON_SALES_DAY  

## t = 12.241, df = 44, p-value = 9.187e-16  

## alternative hypothesis: true mean is not equal to 0  

## 95 percent confidence interval:  

## 4.225688 5.891387  

## sample estimates:  

## mean of x  

## 5.058538

median(timipay$DEPOSIT_ON_SALES_DAY)

## [1] 4.771372

sum(timipay$PAID_IN_FULL)

## [1] 4

```

```

sum(timepay$RETURNED)

## [1] 7

sum(timepay$DEFAULT)

## [1] 4

sum(timepay$PAYMENT_COMPLETE)

## [1] 34

```

## 1.4 Overview of message groups - Table 2

Together with balance check later

```

No_Message = Fulldata[which(Fulldata$GROUP == "No Message"), ]
Saves_Time_Money = Fulldata[which(Fulldata$GROUP == "Saves Time and Money"), ]
Improves_Health = Fulldata[which(Fulldata$GROUP == "Improves Health"), ]
Time_Money_Health = Fulldata[which(Fulldata$GROUP == "Time, Money and Health"), ]

library(data.table)

##
## Attaching package: 'data.table'

## The following objects are masked from 'package:dplyr':
##       between, first, last

## The following object is masked from 'package:purrr':
##       transpose

table2 = transpose(data.frame(c(mean(No_Message$MAXBID,na.rm = T),sd(No_Message$MAXBID,na.rm = T),median(No_Message$MAXBID,na.rm = T),
c(mean(Saves_Time_Money$MAXBID,na.rm = T),sd(Saves_Time_Money$MAXBID,na.rm = T),median(Saves_Time_Money$MAXBID,na.rm = T),
c(mean(Improves_Health$MAXBID,na.rm = T),sd(Improves_Health$MAXBID,na.rm = T),median(Improves_Health$MAXBID,na.rm = T),
c(mean(Time_Money_Health$MAXBID,na.rm = T),sd(Time_Money_Health$MAXBID,na.rm = T),median(Time_Money_Health$MAXBID,na.rm = T),
c(mean(No_Message$MAXBIDNOVEL,na.rm = T),sd(No_Message$MAXBIDNOVEL,na.rm = T),median(No_Message$MAXBIDNOVEL,na.rm = T),
c(mean(Saves_Time_Money$MAXBIDNOVEL,na.rm = T),sd(Saves_Time_Money$MAXBIDNOVEL,na.rm = T),median(Saves_Time_Money$MAXBIDNOVEL,na.rm = T),
c(mean(Improves_Health$MAXBIDNOVEL,na.rm = T),sd(Improves_Health$MAXBIDNOVEL,na.rm = T),median(Improves_Health$MAXBIDNOVEL,na.rm = T),
c(mean(Time_Money_Health$MAXBIDNOVEL,na.rm = T),sd(Time_Money_Health$MAXBIDNOVEL,na.rm = T),median(Time_Money_Health$MAXBIDNOVEL,na.rm = T)

```

```

colnames(table2) <- c("mean", "sd", "median", "p-value")

table2

##      mean      sd median p-value
## 1 4.579009 4.819203 3.976143    10
## 2 4.474517 4.135269 3.976143     7
## 3 5.503134 5.220355 3.976143    19
## 4 4.877390 4.281005 3.976143    11
## 5 6.732729 6.874040 4.771372    10
## 6 7.171327 6.376340 5.964215     7
## 7 6.815442 6.349570 4.771372    19
## 8 6.608321 5.903200 4.771372    11

```

### **Perform Joint test**

Note the assumptions for the F Test for comparing three or more means include:

1. The populations from which the samples were obtained must be normally or approximately normally distributed.
2. The samples must be independent of one another.
3. The variances of the populations must be equal.

Specifically, we cannot guarantee there is no endogeneity issue, which will violate assumption 2 and 3. To safely test the hypothesis that the means of all the groups are equal, we adopt both ANOVA and Kruskal-Wallis test for comparison

We report the nonparametric joint test for the means here

```

Fulldata$GROUP<- factor(Fulldata$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money"))

Maxbid_mean <- tapply(Fulldata$MAXBID, Fulldata$GROUP)
Maxbid_sd <- tapply(Fulldata$MAXBID, Fulldata$GROUP, sd)

# ANOVA F-test
Maxbid_ANOVA <- lm(MAXBID ~ GROUP, Fulldata)
anova(Maxbid_ANOVA)

## Analysis of Variance Table
##
## Response: MAXBID
##             Df Sum Sq Mean Sq F value    Pr(>F)
## GROUP          3    337  112.216  5.2207 0.001364 ***
## Residuals 2121   45590   21.494
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

# Nonparametric test
kruskal.test(MAXBID ~ GROUP, Fulldata)

##
## Kruskal-Wallis rank sum test
##
## data: MAXBID by GROUP
## Kruskal-Wallis chi-squared = 11.644, df = 3, p-value = 0.008708

```

```

Fulldata$GROUP<- factor(Fulldata$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money"))

Maxbidnovel_mean <- tapply(Fulldata$MAXBIDNOVEL, Fulldata$GROUP)
Maxbidnovel_sd <- tapply(Fulldata$MAXBIDNOVEL, Fulldata$GROUP, sd)

# ANOVA F-test
Maxbidnovel_ANOVA <- lm(MAXBIDNOVEL ~ GROUP, Fulldata)
anova(Maxbidnovel_ANOVA)

## Analysis of Variance Table
##
## Response: MAXBIDNOVEL
##           Df Sum Sq Mean Sq F value Pr(>F)
## GROUP      3     94   31.406  0.7701 0.5107
## Residuals 2131  86905   40.781

# Nonparametric test
kruskal.test(MAXBIDNOVEL ~ GROUP, Fulldata)

##
## Kruskal-Wallis rank sum test
##
## data: MAXBIDNOVEL by GROUP
## Kruskal-Wallis chi-squared = 5.585, df = 3, p-value = 0.1336

```

## 2 Balance check

Check if randomization is successful.

$$Y_i = \beta_0 + \beta_1 Message_i + \epsilon_i$$

$$X_i = \beta_0 + \beta_1 Message_i + \epsilon_i$$

where  $Y_{i0}$  in (1) denotes the bidprice and novel bid price,  $X_{i0}$  in (1) denotes all the explanatory variables in the following section (H, W, C).  $Message_i$  is the variable of the four groups.

Next, we perform an overall joint test of balance in characteristics using the following specification

$$Message_i = \alpha + \beta' Y_i + \gamma' X_i + \epsilon_i$$

### 2.1 A detailed illustration on age

#### (1) Table of descriptive statistics by treatment group

```

### Number of missing values
sum(is.na(Data$AGE))

```

```

## [1] 6

```

```

### 6 missing values reported

### Clean the incomplete observations, note: save in a new "data" in lower
data=Data[!is.na(Data$AGE), ]

### Set the preferred ordering of groups in tables and graphs
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time and Money"))

### Table of descriptive statistics by treatment group
Age_mean <- tapply(data$AGE, data$GROUP, mean)
Age_sd <- tapply(data$AGE, data$GROUP, sd)
n           <- tapply(data$AGE, data$GROUP, length)
data.frame(mean = Age_mean, std.dev = Age_sd, n = n)

##                                     mean   std.dev    n
## No Message                 38.76842 13.56398 570
## Improves Health             40.39640 13.89652 555
## Saves Time and Money       39.45971 13.32264 546
## Time, Money and Health    39.09515 13.42163 557

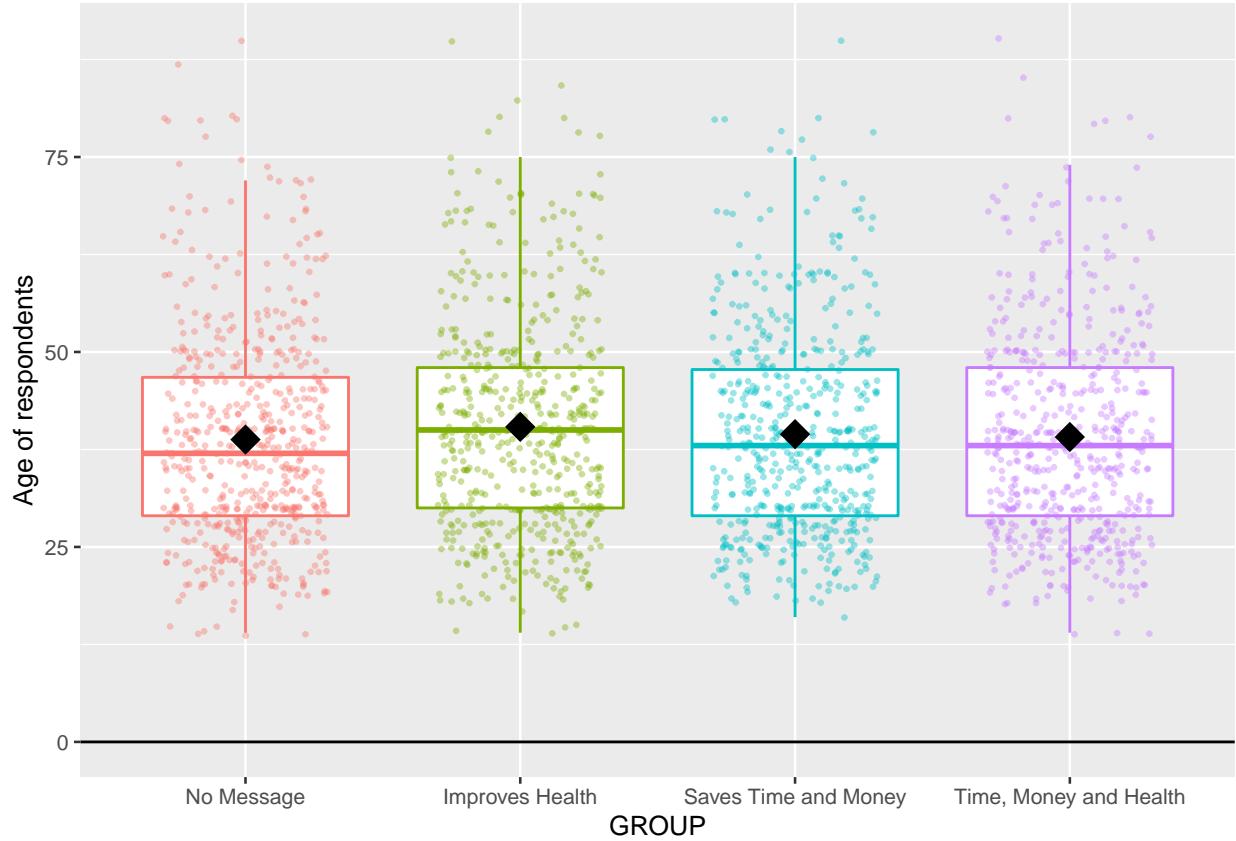
```

## (2) Visualization with strip chart - For non-technical Memo

```

ggplot(data, aes(GROUP, AGE, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.5, show.legend=FALSE) +
  ylab(label = "Age of respondents") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



### (3) Blance Check - Fixed effects ANOVA and Nonparametric Test- For Technical Memo

We adopt both ANOVA and Kruskal test here, again.

```
### Anova Test
Age_ANOVA <- lm(AGE ~ GROUP, data)
anova(Age_ANOVA)

## Analysis of Variance Table
##
## Response: AGE
##             Df  Sum Sq Mean Sq F value Pr(>F)
## GROUP         3    831   276.90  1.5073 0.2107
## Residuals 2224 408562   183.71

### Krusal-Wallis test
kruskal.test(AGE ~ GROUP, data )

##
## Kruskal-Wallis rank sum test
##
## data: AGE by GROUP
## Kruskal-Wallis chi-squared = 4.665, df = 3, p-value = 0.198
```

Both tests do not reject the null hypothesis, implying no significant differences in age among the four groups.

## 2.2 All Variables

### 2.2.1 Household socio-economic and demographic variables - H

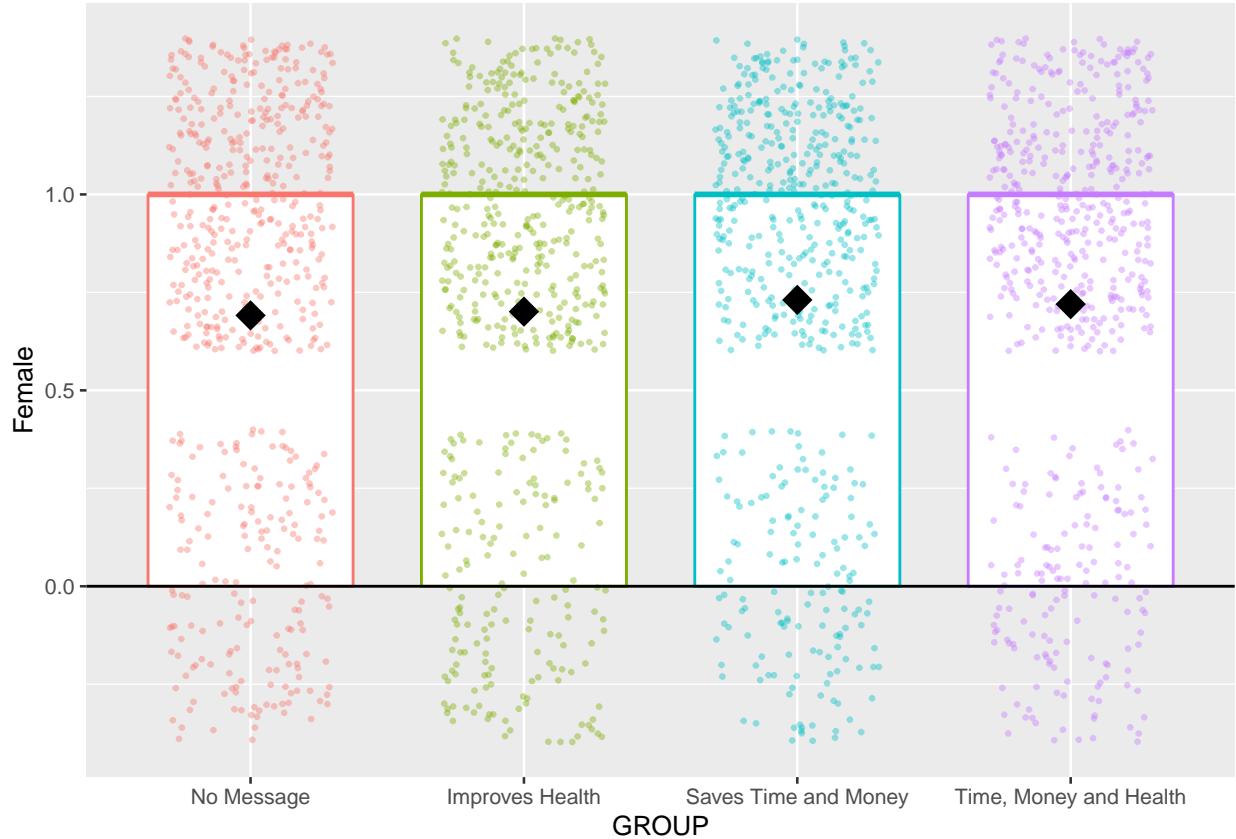
We ignore *gatherwood or buywood last month* due to possible error in memory and low impact from a past event.

1.FEMALE

```
### Summary Stats
### Use the dummy for female, delete all the missing values
data=Data[!is.na(Data$FEMALE), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time, Money and Health"))
FEMALE_mean <- tapply(data$FEMALE, data$GROUP, mean)
FEMALE_sd <- tapply(data$FEMALE, data$GROUP, sd)
n <- tapply(data$FEMALE, data$GROUP, length)
data.frame(mean = FEMALE_mean, std.dev = FEMALE_sd, n = n)

##                                     mean   std.dev   n
## No Message                 0.6912281 0.4623926 570
## Improves Health            0.7009009 0.4582764 555
## Saves Time and Money      0.7307692 0.4439668 546
## Time, Money and Health    0.7199282 0.4494377 557

### Visualization
ggplot(data, aes(GROUP, FEMALE, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.5, show.legend=FALSE) +
  ylab(label = "Female") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)
```



```
### Krusal-Wallis test
kruskal.test(GENDER ~ GROUP, data )
```

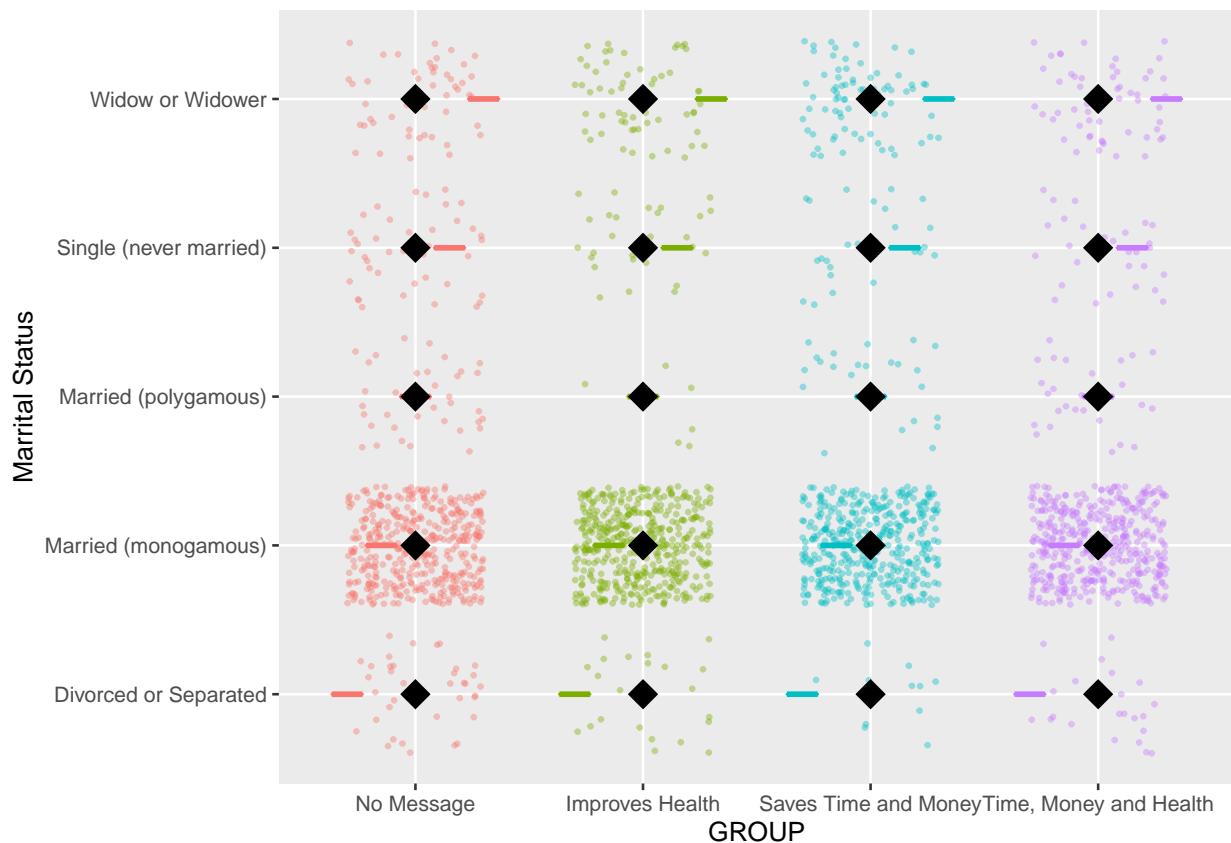
```
##
## Kruskal-Wallis rank sum test
##
## data: GENDER by GROUP
## Kruskal-Wallis chi-squared = 2.608, df = 3, p-value = 0.4561
```

3. MARRIED - marital status. We use MARRIED for balance check based on the distribution of the 5 different types. We use STATUS for visualization.

```
### Summary Stats
### Use the dummy for STATUS, delete all the missing values (not clean upon MARRIED since it is a dummy
data=Data[!is.na(Data$STATUS), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money", "Time, Money and Health"))
MARRIED_mean <- tapply(data$MARRIED, data$GROUP, mean)
MARRIED_sd <- tapply(data$MARRIED, data$GROUP, sd)
n <- tapply(data$MARRIED, data$GROUP, length)
data.frame(mean = MARRIED_mean, std.dev = MARRIED_sd, n = n)
```

	mean	std.dev	n
## No Message	0.7789474	0.4153203	570
## Improves Health	0.8072072	0.3948476	555
## Saves Time and Money	0.7875458	0.4094196	546
## Time, Money and Health	0.8132855	0.3900325	557

```
### Visualization
ggplot(data, aes(GROUP, STATUS, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.5, show.legend=FALSE) +
  ylab(label = "Marrital Status") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)
```



```
### Krusal-Wallis test
kruskal.test(STATUS ~ GROUP, data )
```

```
##
## Kruskal-Wallis rank sum test
##
## data: STATUS by GROUP
## Kruskal-Wallis chi-squared = 9.5644, df = 3, p-value = 0.02266
```

4. WIFECOOK - whether the wife is the primary cook. We use WIFECOOK for balance check based on the distribution of the 4 different types. We use PRIMARYCOOK2 for visualization.

```
data=Data[!is.na(Data$PRIMARYCOOK2), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money", "Time, Money and Health"))
WIFECOOK_mean <- tapply(data$WIFECOOK, data$GROUP, mean)
```

```

WIFECOOK_sd <- tapply(data$WIFECOOK, data$GROUP, sd)
n <- tapply(data$WIFECOOK, data$GROUP, length)
data.frame(mean = WIFECOOK_mean, std.dev = WIFECOOK_sd, n = n)

```

```

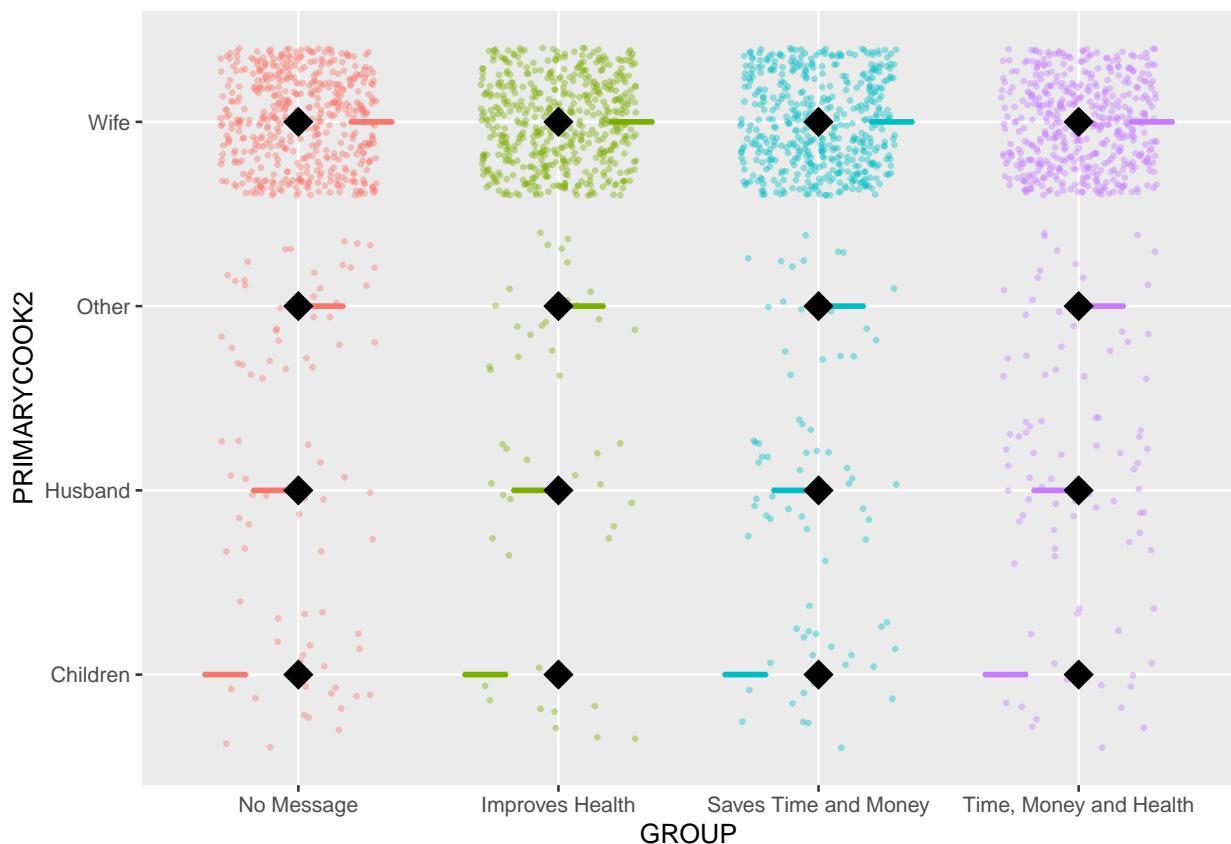
##                               mean   std.dev   n
## No Message           0.8596491 0.3476558 570
## Improves Health      0.9189189 0.2732058 555
## Saves Time and Money 0.8681319 0.3386576 546
## Time, Money and Health 0.8420108 0.3650588 557

```

```

### Visualization
ggplot(data, aes(GROUP, PRIMARYCOOK2, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.5, show.legend=FALSE) +
  ylab(label = "PRIMARYCOOK2") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```

### Kruskal-Wallis test
kruskal.test(WIFECOOK ~ GROUP, data )

```

```

##
## Kruskal-Wallis rank sum test

```

```

##  

## data: WIFECOOK by GROUP  

## Kruskal-Wallis chi-squared = 16.288, df = 3, p-value = 0.0009898

```

5. JOINTDECISION - whether husband and wife make decisions jointly. We use JOINTDECISION for balance check based on the distribution of the 5 different types. We use DECISIONS2 for visualization.

```

data=Data[!is.na(Data$DECISIONS2), ]  

data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time  

JOINTDECISION_mean <- tapply(data$JOINTDECISION, data$GROUP, mean)  

JOINTDECISION_sd <- tapply(data$JOINTDECISION, data$GROUP, sd)  

n <- tapply(data$JOINTDECISION, data$GROUP, length)  

data.frame(mean = JOINTDECISION_mean, std.dev = JOINTDECISION_sd, n = n)

##                                     mean   std.dev   n  

## No Message           0.4315789 0.4957315 570  

## Improves Health      0.3387387 0.4737079 555  

## Saves Time and Money 0.4542125 0.4983557 546  

## Time, Money and Health 0.5529623 0.4976340 557

### Visualization
ggplot(data, aes(GROUP, DECISIONS2, color=GROUP)) +  

  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +  

  geom_jitter(width=0.3, alpha = 0.4, size=0.5, show.legend=FALSE) +  

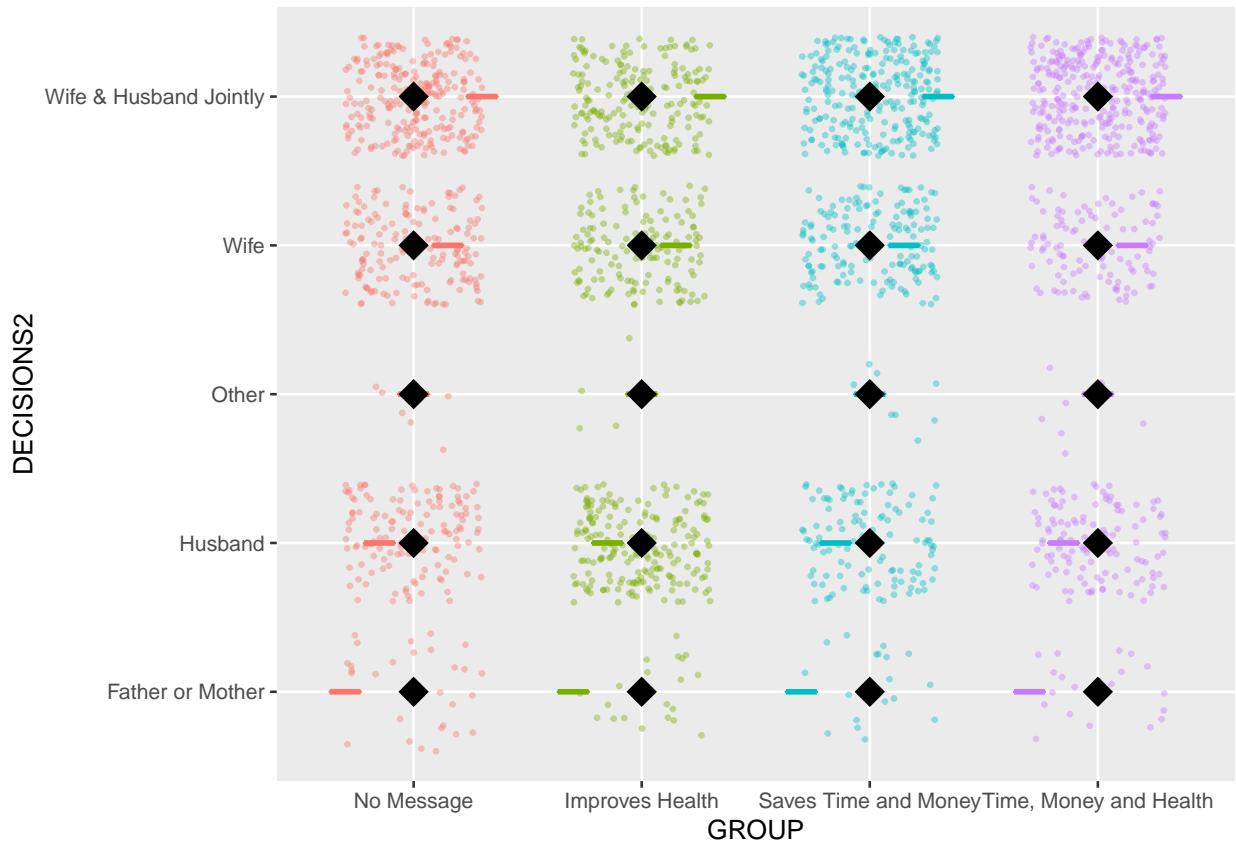
  ylab(label = "DECISIONS2") +  

  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +  

  geom_hline(yintercept = 0) +  

  theme_grey(base_size=10)

```



```
### Krusal-Wallis test
kruskal.test(JOINTDECISION ~ GROUP, data )
```

```
##
## Kruskal-Wallis rank sum test
##
## data: JOINTDECISION by GROUP
## Kruskal-Wallis chi-squared = 52.253, df = 3, p-value = 2.646e-11
```

## 6. KNOWLUNCH - Respondent knows how many people ate lunch

```
### Create KNOWLUNCH_Dummy
data_plus=data
data=Data[!is.na(Data$KNOWLUNCH), ]
data$KNOWLUNCH_Dummy = data$KNOWLUNCH
data$KNOWLUNCH_Dummy[data$KNOWLUNCH_Dummy == "No"] <- 0
data$KNOWLUNCH_Dummy[data$KNOWLUNCH_Dummy == "Yes"] <- 1
data_plus$KNOWLUNCH_Dummy = data$KNOWLUNCH_Dummy

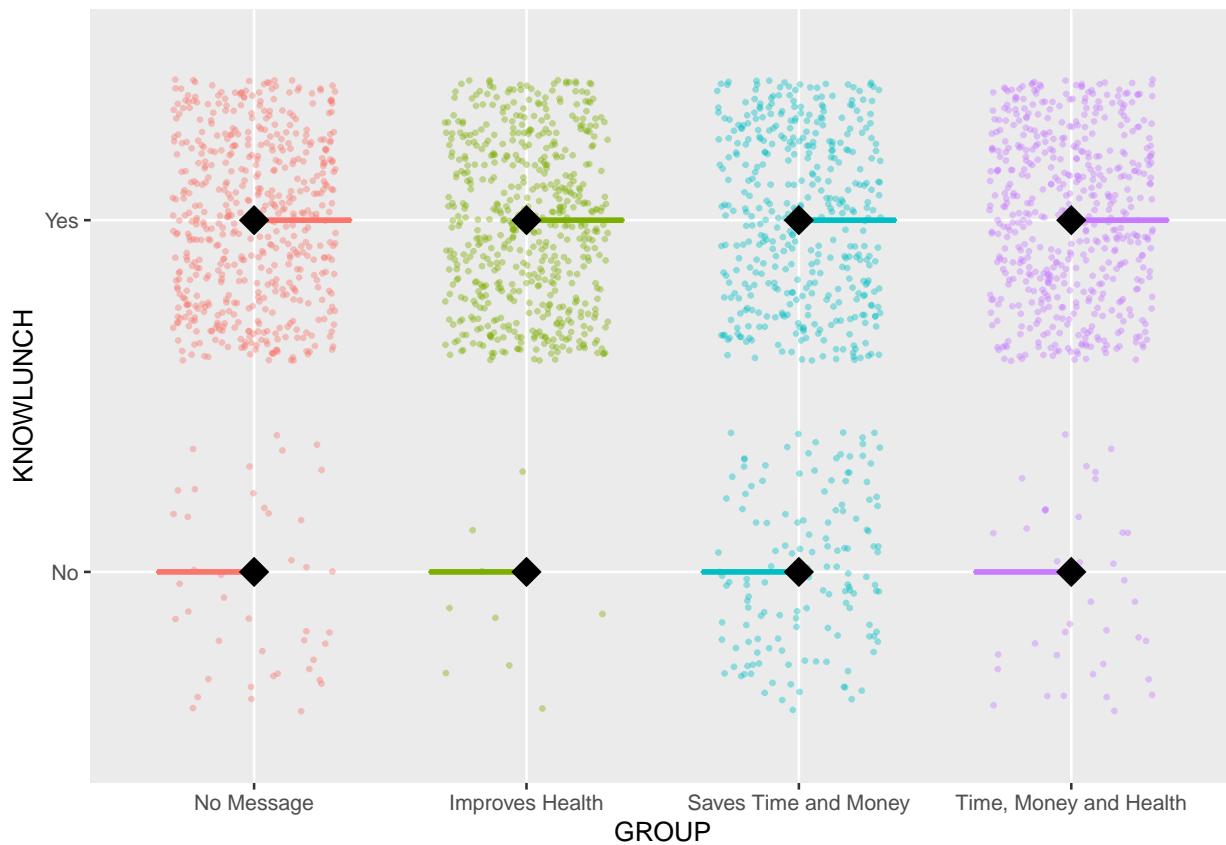
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time
KNOWLUNCH_Dummy_mean <- tapply(as.numeric(data$KNOWLUNCH_Dummy), data$GROUP, mean)
KNOWLUNCH_Dummy_sd <- tapply(as.numeric((data$KNOWLUNCH_Dummy)), data$GROUP, sd)
n <- tapply(data$KNOWLUNCH_Dummy, data$GROUP, length)
data.frame(mean = KNOWLUNCH_Dummy_mean, std.dev = KNOWLUNCH_Dummy_sd, n = n)
```

```

##                               mean   std.dev   n
## No Message            0.9263158 0.2614858 570
## Improves Health       0.9837838 0.1264201 555
## Saves Time and Money 0.7399267 0.4390766 546
## Time, Money and Health 0.9299820 0.2554066 557

### Visualization
ggplot(data, aes(GROUP, KNOWLUNCH, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.5, show.legend=FALSE) +
  ylab(label = "KNOWLUNCH") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```

### Krusal-Wallis test
kruskal.test(KNOWLUNCH_Dummy ~ GROUP, data )

```

```

##
## Kruskal-Wallis rank sum test
##
## data: KNOWLUNCH_Dummy by GROUP
## Kruskal-Wallis chi-squared = 200.84, df = 3, p-value < 2.2e-16

```

```
data_plus$KNOWLUNCH_Dummy=as.numeric(data_plus$KNOWLUNCH_Dummy)
```

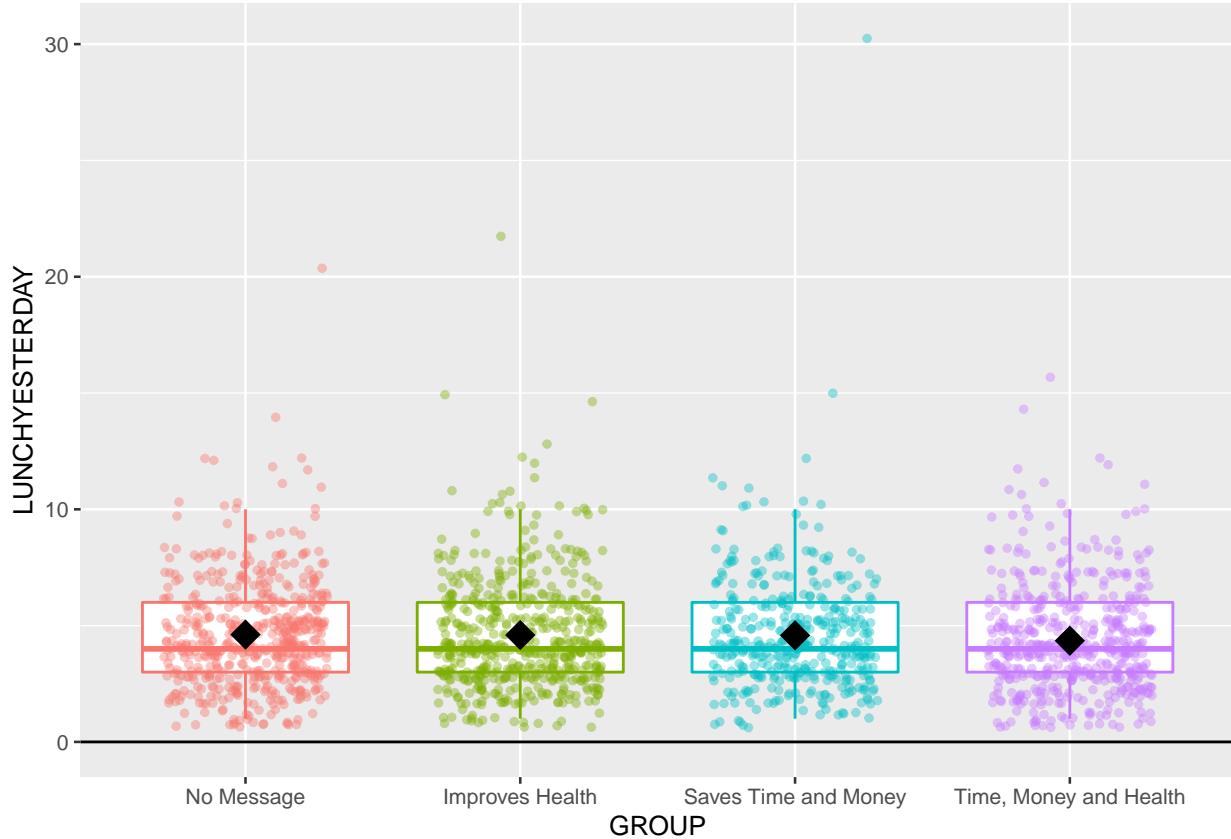
7. LUNCHYESTERDAY - How many ate lunch at HH yesterday (252 missing)

```
### Summary
data=Data[!is.na(Data$LUNCHYESTERDAY), ]

data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money", "Time"))
LUNCHYESTERDAY_mean <- tapply(as.numeric(data$LUNCHYESTERDAY), data$GROUP, mean)
LUNCHYESTERDAY_sd <- tapply(as.numeric((data$LUNCHYESTERDAY)), data$GROUP, sd)
n <- tapply(data$LUNCHYESTERDAY, data$GROUP, length)
data.frame(mean = LUNCHYESTERDAY_mean, std.dev = LUNCHYESTERDAY_sd, n = n)

##                                     mean   std.dev    n
## No Message           4.614367 2.286874 529
## Improves Health      4.595238 2.371678 546
## Saves Time and Money 4.581683 2.450657 404
## Time, Money and Health 4.349421 2.251050 518

### Visualization
ggplot(data, aes(GROUP, LUNCHYESTERDAY, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=1, show.legend=FALSE) +
  ylab(label = "LUNCHYESTERDAY") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)
```



```
### Krusal-Wallis test
kruskal.test(LUNCHYESTERDAY ~ GROUP, data )
```

```
##
## Kruskal-Wallis rank sum test
##
## data: LUNCHYESTERDAY by GROUP
## Kruskal-Wallis chi-squared = 5.7539, df = 3, p-value = 0.1242
```

8. TYPICALNUMEATING\_Dummy - Was Yesterday Lunch Typical (252 missing) - Not included in joint test

```
### Create TYPICALNUMEATING_Dummy
data=data_plus
data$TYPICALNUMEATING_Dummy = data$TYPICALNUMEATING
data$TYPICALNUMEATING_Dummy[data$TYPICALNUMEATING_Dummy != "Yes"] <- 0
data$TYPICALNUMEATING_Dummy[data$TYPICALNUMEATING_Dummy == "Yes"] <- 1
data_plus$TYPICALNUMEATING_Dummy = data$TYPICALNUMEATING_Dummy

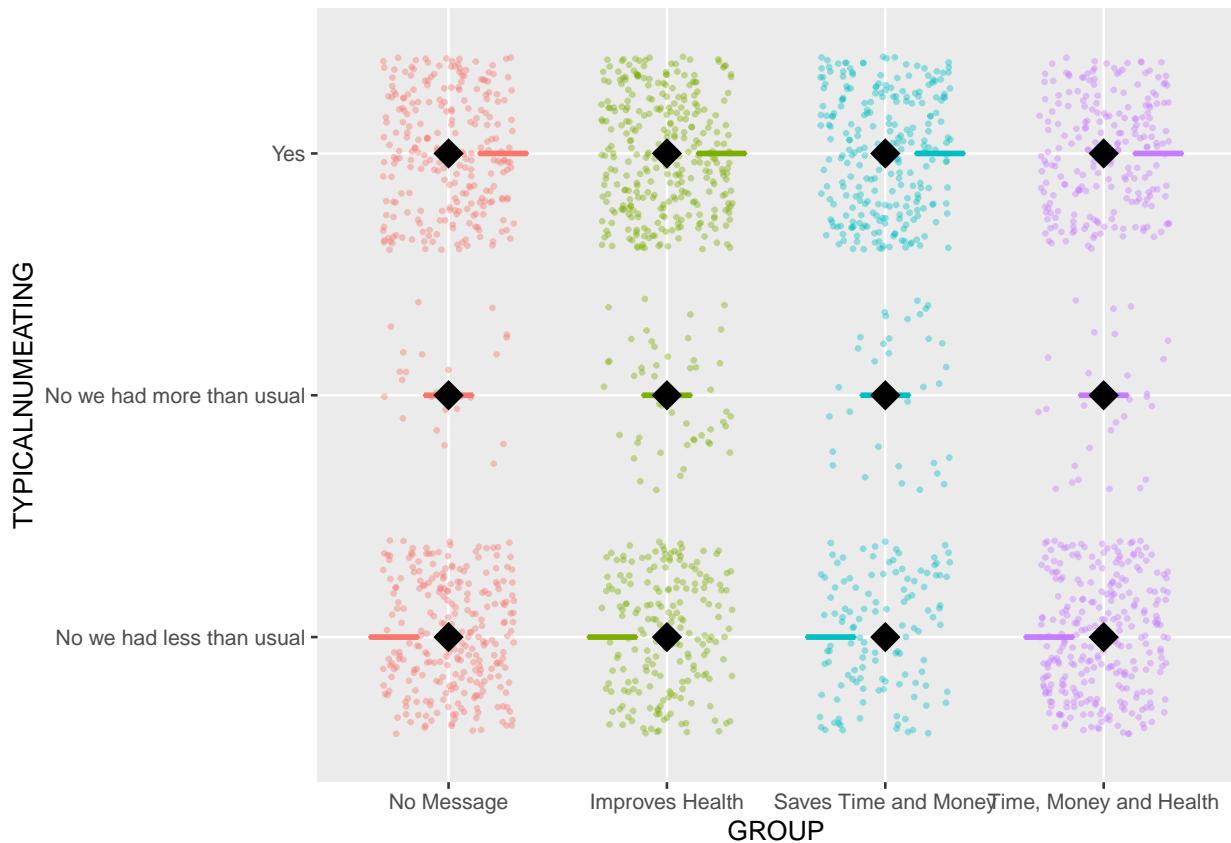
data=data[!is.na(data$TYPICALNUMEATING_Dummy), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money", "Time, Money and Health"))
TYPICALNUMEATING_Dummy_mean <- tapply(as.numeric(data$TYPICALNUMEATING_Dummy), data$GROUP, mean)
TYPICALNUMEATING_Dummy_sd <- tapply(as.numeric((data$TYPICALNUMEATING_Dummy)), data$GROUP, sd)
n <- tapply(data$TYPICALNUMEATING_Dummy, data$GROUP, length)
data.frame(mean = TYPICALNUMEATING_Dummy_mean, std.dev = TYPICALNUMEATING_Dummy_sd, n = n)
```

```

##          mean   std.dev    n
## No Message      0.4678030 0.4994355 528
## Improves Health 0.5622711 0.4965621 546
## Saves Time and Money 0.6197531 0.4860479 405
## Time, Money and Health 0.4131274 0.4928713 518

### Visualization
ggplot(data, aes(GROUP, TYPICALNUMEATING, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.5, show.legend=FALSE) +
  ylab(label = "TYPICALNUMEATING") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```

### Krusal-Wallis test
kruskal.test(TYPICALNUMEATING_Dummy ~ GROUP, data )

```

```

##
## Kruskal-Wallis rank sum test
##
## data: TYPICALNUMEATING_Dummy by GROUP
## Kruskal-Wallis chi-squared = 48.682, df = 3, p-value = 1.525e-10

```

## 9. HOWPAID

```

### Create Cashpaid_Dummy
data=data_plus
data$CASHPAID_Dummy = data$HOWPAID
data$CASHPAID_Dummy[data$CASHPAID_Dummy == "In-kind only"] <- 0
data$CASHPAID_Dummy[data$CASHPAID_Dummy == "Not paid"] <- 0
data$CASHPAID_Dummy[data$CASHPAID_Dummy == "Cash only"] <- 1
data$CASHPAID_Dummy[data$CASHPAID_Dummy == "Cash and in-kind"] <- 1
data_plus$CASHPAID_Dummy = as.numeric(data$CASHPAID_Dummy)

data=data[!is.na(data$CASHPAID_Dummy), ]

data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time, Money and Health"))
CASHPAID_Dummy_mean <- tapply(as.numeric(data$CASHPAID_Dummy), data$GROUP, mean)
CASHPAID_Dummy_sd <- tapply(as.numeric((data$CASHPAID_Dummy)), data$GROUP, sd)
n <- tapply(data$CASHPAID_Dummy, data$GROUP, length)
data.frame(mean = CASHPAID_Dummy_mean, std.dev = CASHPAID_Dummy_sd, n = n)

##                                     mean   std.dev   n
## No Message           0.9781818 0.14622251 550
## Improves Health      0.9907834 0.09566992 434
## Saves Time and Money 0.9912088 0.09345115 455
## Time, Money and Health 1.0000000 0.00000000 515

### Visualization
ggplot(data, aes(GROUP, CASHPAID_Dummy, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.5, show.legend=FALSE) +
  ylab(label = "Cashpaid Dummy") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```
### Krusal-Wallis test
kruskal.test(CASHPAID_Dummy ~ GROUP, data )
```

```
##
## Kruskal-Wallis rank sum test
##
## data: CASHPAID_Dummy by GROUP
## Kruskal-Wallis chi-squared = 12.741, df = 3, p-value = 0.005231
```

## 2.2.2 Wealth variables - W

We ignore SPOUSE phone since there are 473 missing values (about 20% of whole data set).

1. HH\_PHONES - Count of phones owned by household

```
### Summary
data=Data[!is.na(Data$HH_PHONES ), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time
HH_PHONES_mean <- tapply(as.numeric(data$HH_PHONES), data$GROUP, mean)
HH_PHONES_sd <- tapply(as.numeric((data$HH_PHONES)), data$GROUP, sd)
n <- tapply(data$HH_PHONES, data$GROUP, length)
data.frame(mean = HH_PHONES_mean, std.dev = HH_PHONES_sd, n = n)
```

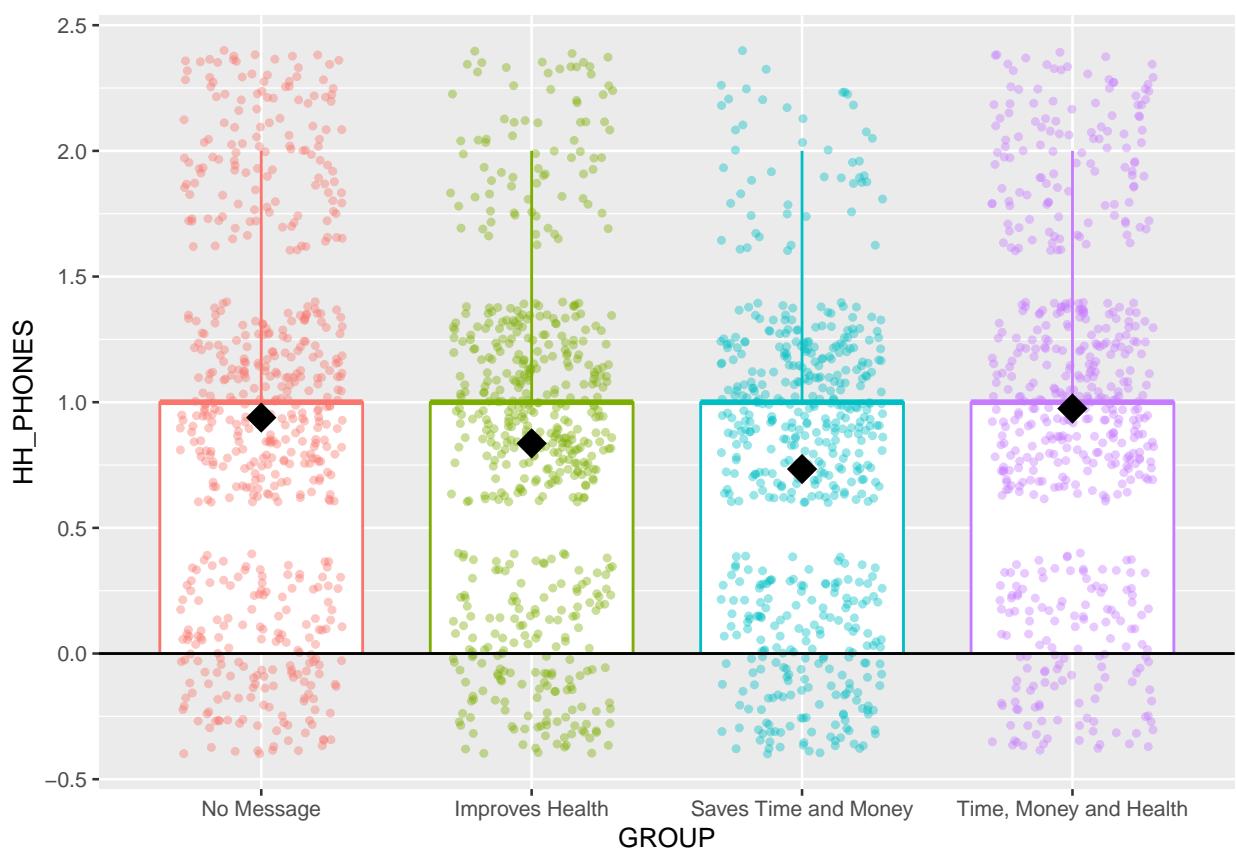
	mean	std.dev	n
No Message	0.98	0.05	100
Improves Health	0.98	0.05	100
Saves Time and Money	0.98	0.05	100
Time, Money and Health	0.98	0.05	100

```

## No Message          0.9388112 0.7258770 572
## Improves Health    0.8360360 0.6500198 555
## Saves Time and Money 0.7340619 0.6088955 549
## Time, Money and Health 0.9749104 0.6931943 558

### Visualization
ggplot(data, aes(GROUP, HH_PHONES, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "HH_PHONES") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```

### Kruskal-Wallis test
kruskal.test(HH_PHONES ~ GROUP, data )

```

```

##
## Kruskal-Wallis rank sum test
##
## data: HH_PHONES by GROUP
## Kruskal-Wallis chi-squared = 39.642, df = 3, p-value = 1.269e-08

```

## 2. INCOME - Earns income

```

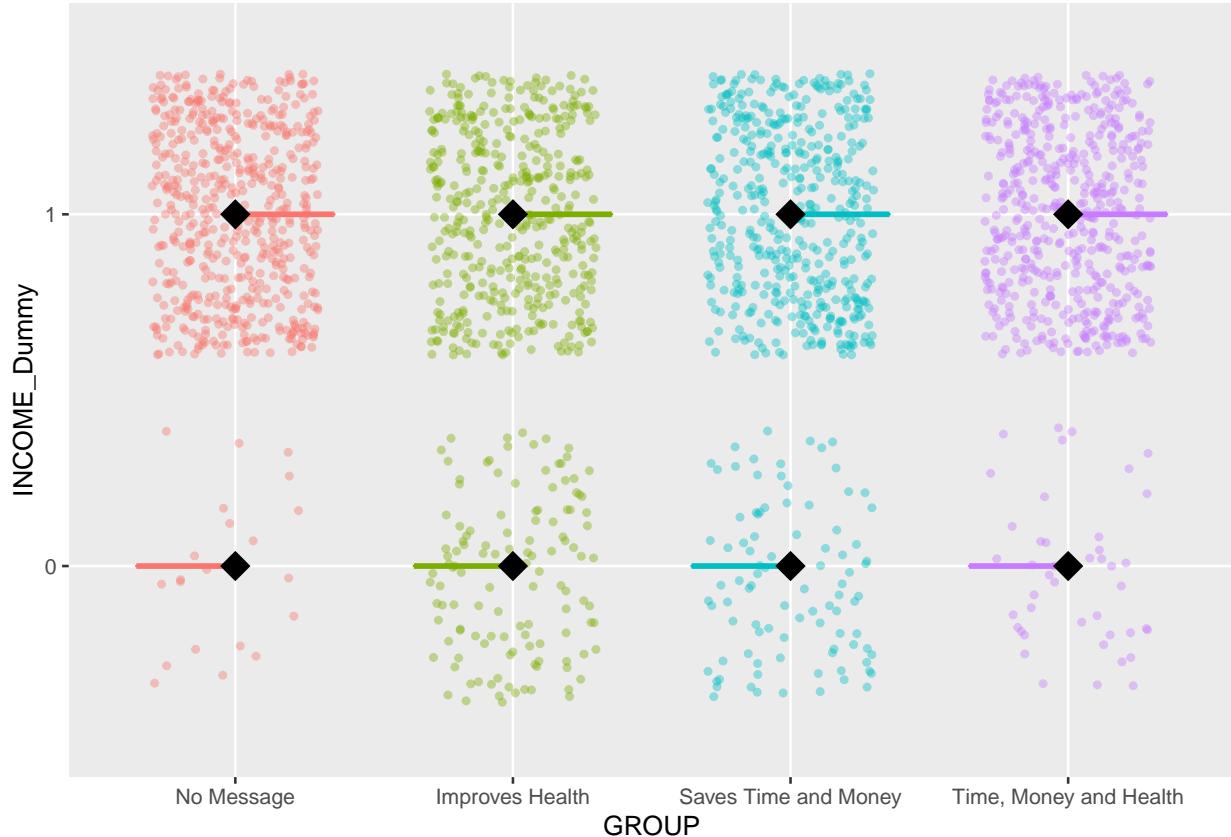
### Create INCOME_Dummy
data=Data[!is.na(Data$INCOME), ]
data$INCOME_Dummy = data$INCOME
data$INCOME_Dummy[data$INCOME_Dummy != "Yes"] <- 0
data$INCOME_Dummy[data$INCOME_Dummy == "Yes"] <- 1
data_plus$INCOME_Dummy = data$INCOME_Dummy

### Summary
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time and Money"))
Income_mean <- tapply(as.numeric(data$INCOME_Dummy), data$GROUP, mean)
Income_sd <- tapply(as.numeric((data$INCOME_Dummy)), data$GROUP, sd)
n <- tapply(data$INCOME_Dummy, data$GROUP, length)
data.frame(mean = Income_mean, std.dev = Income_sd, n = n)

##                                     mean   std.dev   n
## No Message                 0.9631579 0.1885395 570
## Improves Health            0.7783784 0.4157125 555
## Saves Time and Money      0.8296703 0.3762669 546
## Time, Money and Health    0.9228007 0.2671473 557

### Visualization
ggplot(data, aes(GROUP, INCOME_Dummy, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "INCOME_Dummy") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```
### Krusal-Wallis test
kruskal.test(INCOME_Dummy ~ GROUP, data )
```

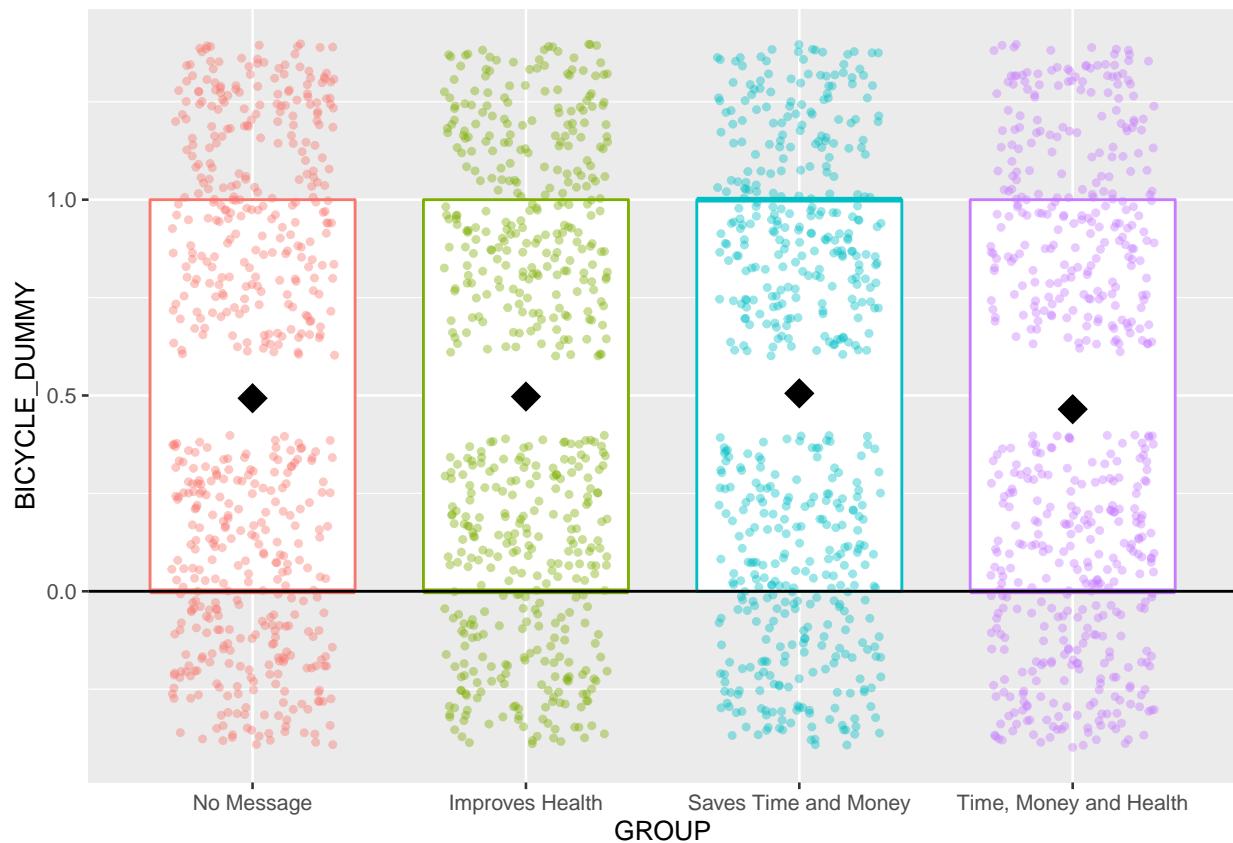
```
##
## Kruskal-Wallis rank sum test
##
## data: INCOME_Dummy by GROUP
## Kruskal-Wallis chi-squared = 109.21, df = 3, p-value < 2.2e-16
```

### 3. VEHICLE1 (BICYCLE\_DUMMY, CAR\_DUMMY, MOTORCYCLE\_DUMMY)

```
### Summary
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time
BICYCLE_DUMMY_mean <- tapply(as.numeric(data$BICYCLE_DUMMY ), data$GROUP, mean)
BICYCLE_DUMMY_sd <- tapply(as.numeric((data$BICYCLE_DUMMY )), data$GROUP, sd)
n <- tapply(data$BICYCLE_DUMMY , data$GROUP, length)
data.frame(mean = BICYCLE_DUMMY_mean, std.dev = BICYCLE_DUMMY_sd, n = n)
```

	mean	std.dev	n
## No Message	0.4929825	0.5003899	570
## Improves Health	0.4972973	0.5004437	555
## Saves Time and Money	0.5054945	0.5004283	546
## Time, Money and Health	0.4649910	0.4992212	557

```
### Visualization
ggplot(data, aes(GROUP, BICYCLE_DUMMY, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "BICYCLE_DUMMY") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)
```



```
### Kruskal-Wallis test
kruskal.test(BICYCLE_DUMMY ~ GROUP, data )
```

```
##
##  Kruskal-Wallis rank sum test
##
## data: BICYCLE_DUMMY by GROUP
## Kruskal-Wallis chi-squared = 2.0561, df = 3, p-value = 0.5609

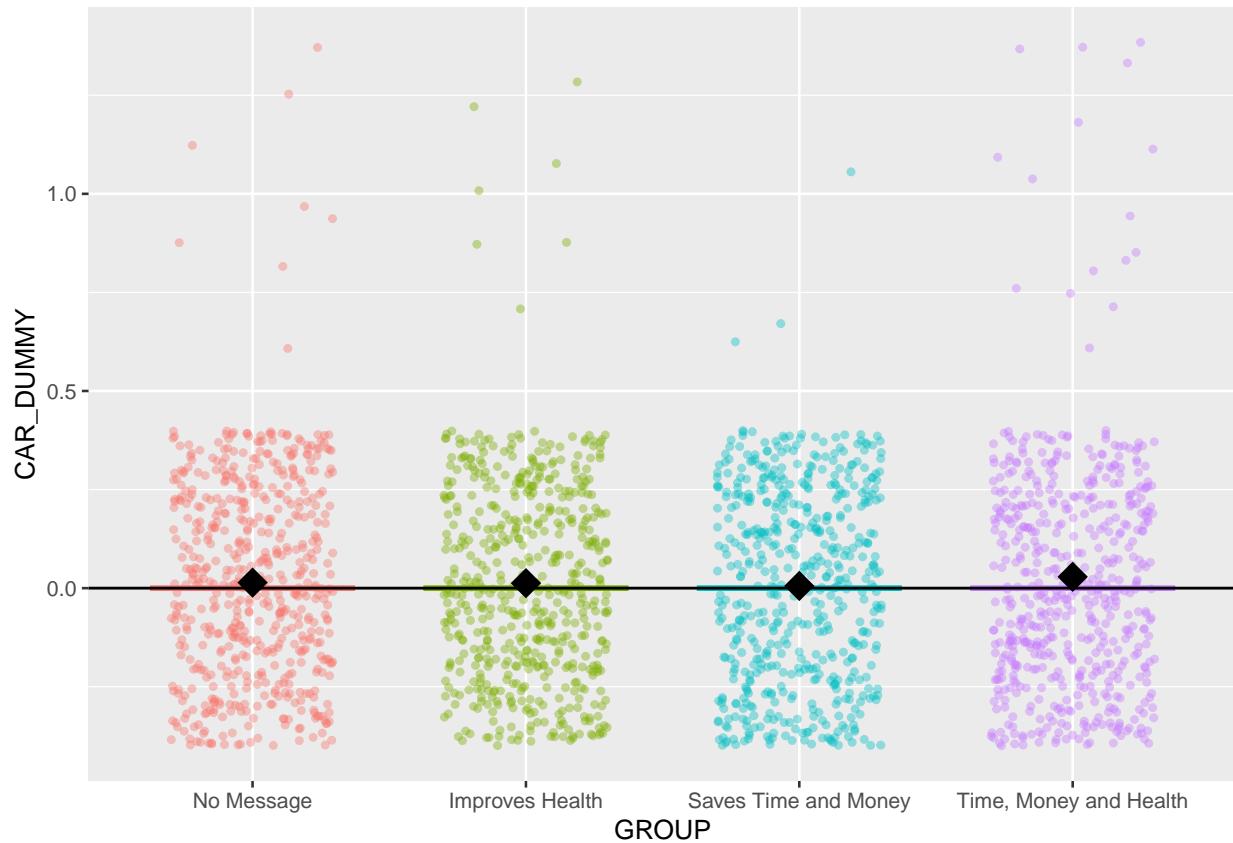
#####
#### Summary
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time, Money and Health"))
CAR_DUMMY_mean <- tapply(as.numeric(data$CAR_DUMMY ), data$GROUP, mean)
CAR_DUMMY_sd <- tapply(as.numeric((data$CAR_DUMMY )), data$GROUP, sd)
n <- tapply(data$CAR_DUMMY , data$GROUP, length)
data.frame(mean = CAR_DUMMY_mean, std.dev = CAR_DUMMY_sd, n = n)
```

```

##                               mean   std.dev   n
## No Message            0.014035088 0.1177388 570
## Improves Health       0.012612613 0.1116961 555
## Saves Time and Money 0.005494505 0.0739888 546
## Time, Money and Health 0.028725314 0.1671836 557

### Visualization
ggplot(data, aes(GROUP, CAR_DUMMY, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "CAR_DUMMY") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```

### Kruskal-Wallis test
kruskal.test(CAR_DUMMY ~ GROUP, data )

```

```

##
##  Kruskal-Wallis rank sum test
##
## data:  CAR_DUMMY by GROUP
## Kruskal-Wallis chi-squared = 10.497, df = 3, p-value = 0.01478

```

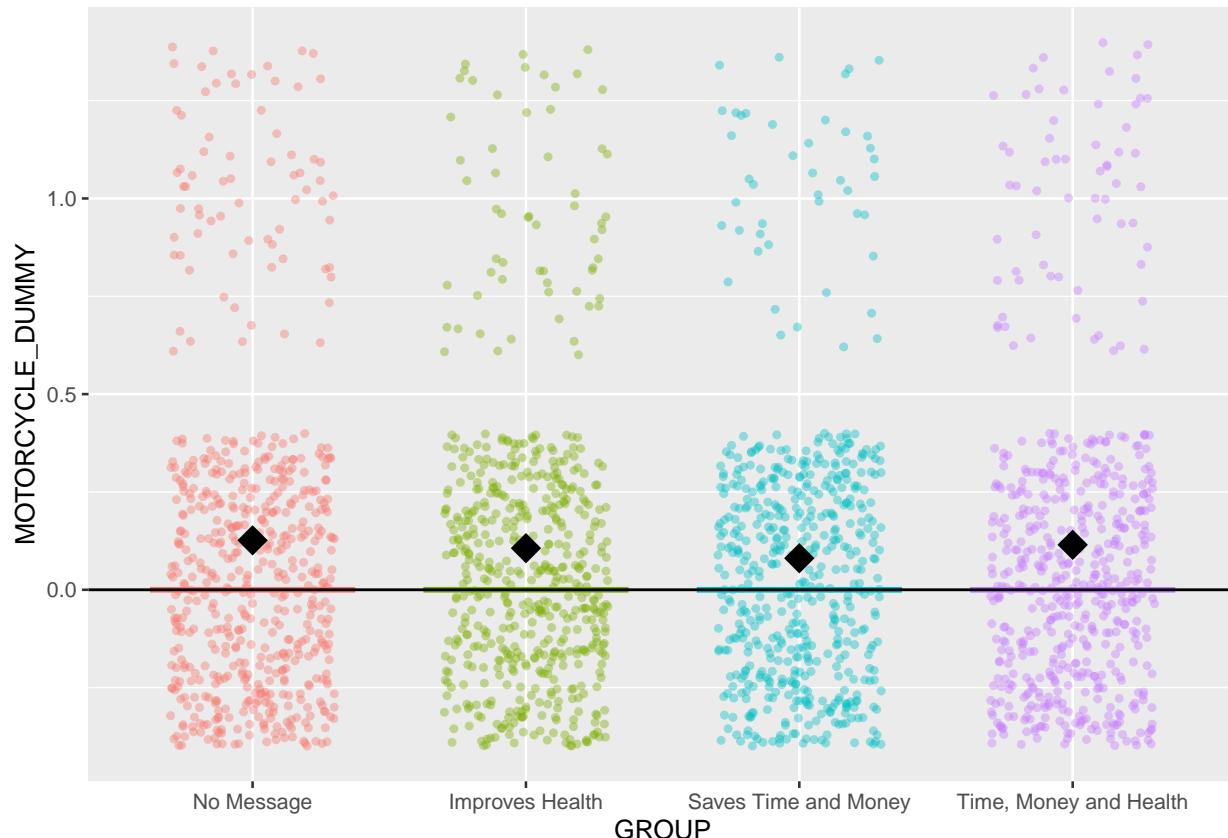
```

#####
### Summary
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money", "Time, Money and Health"))
MOTORCYCLE_DUMMY_mean <- tapply(as.numeric(data$MOTORCYCLE_DUMMY ), data$GROUP, mean)
MOTORCYCLE_DUMMY_sd <- tapply(as.numeric((data$MOTORCYCLE_DUMMY )), data$GROUP, sd)
n <- tapply(data$MOTORCYCLE_DUMMY , data$GROUP, length)
data.frame(mean = MOTORCYCLE_DUMMY_mean, std.dev = MOTORCYCLE_DUMMY_sd, n = n)

##          mean   std.dev   n
## No Message 0.12631579 0.3324967 570
## Improves Health 0.10630631 0.3085073 555
## Saves Time and Money 0.08058608 0.2724480 546
## Time, Money and Health 0.11490126 0.3191894 557

### Visualization
ggplot(data, aes(GROUP, MOTORCYCLE_DUMMY, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "MOTORCYCLE_DUMMY") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```
### Krusal-Wallis test
kruskal.test(MOTORCYCLE_DUMMY ~ GROUP, data )
```

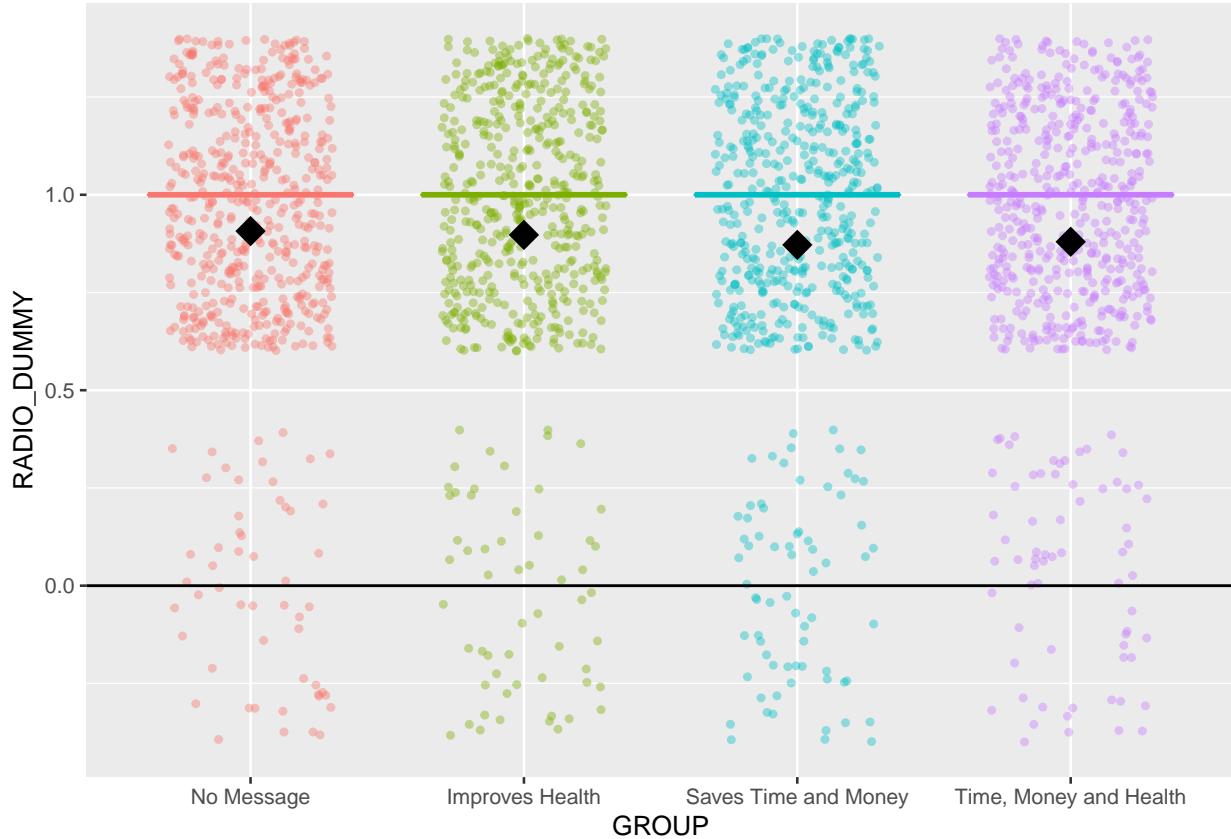
```
##
##  Kruskal-Wallis rank sum test
##
## data:  MOTORCYCLE_DUMMY by GROUP
## Kruskal-Wallis chi-squared = 6.5599, df = 3, p-value = 0.08733
```

#### 4. RADIO\_DUMMY

```
### Summary
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money", "Time, Money and Health"))
RADIO_DUMMY_mean <- tapply(as.numeric(data$RADIO_DUMMY ), data$GROUP, mean)
RADIO_DUMMY_sd <- tapply(as.numeric((data$RADIO_DUMMY )), data$GROUP, sd)
n <- tapply(data$RADIO_DUMMY , data$GROUP, length)
data.frame(mean = RADIO_DUMMY_mean, std.dev = RADIO_DUMMY_sd, n = n)

##           mean   std.dev   n
## No Message      0.9070175 0.2906629 570
## Improves Health 0.8972973 0.3038440 555
## Saves Time and Money 0.8717949 0.3346246 546
## Time, Money and Health 0.8797127 0.3255895 557

### Visualization
ggplot(data, aes(GROUP, RADIO_DUMMY, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "RADIO_DUMMY") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)
```



```
### Krusal-Wallis test
kruskal.test(RADIO_DUMMY ~ GROUP, data )
```

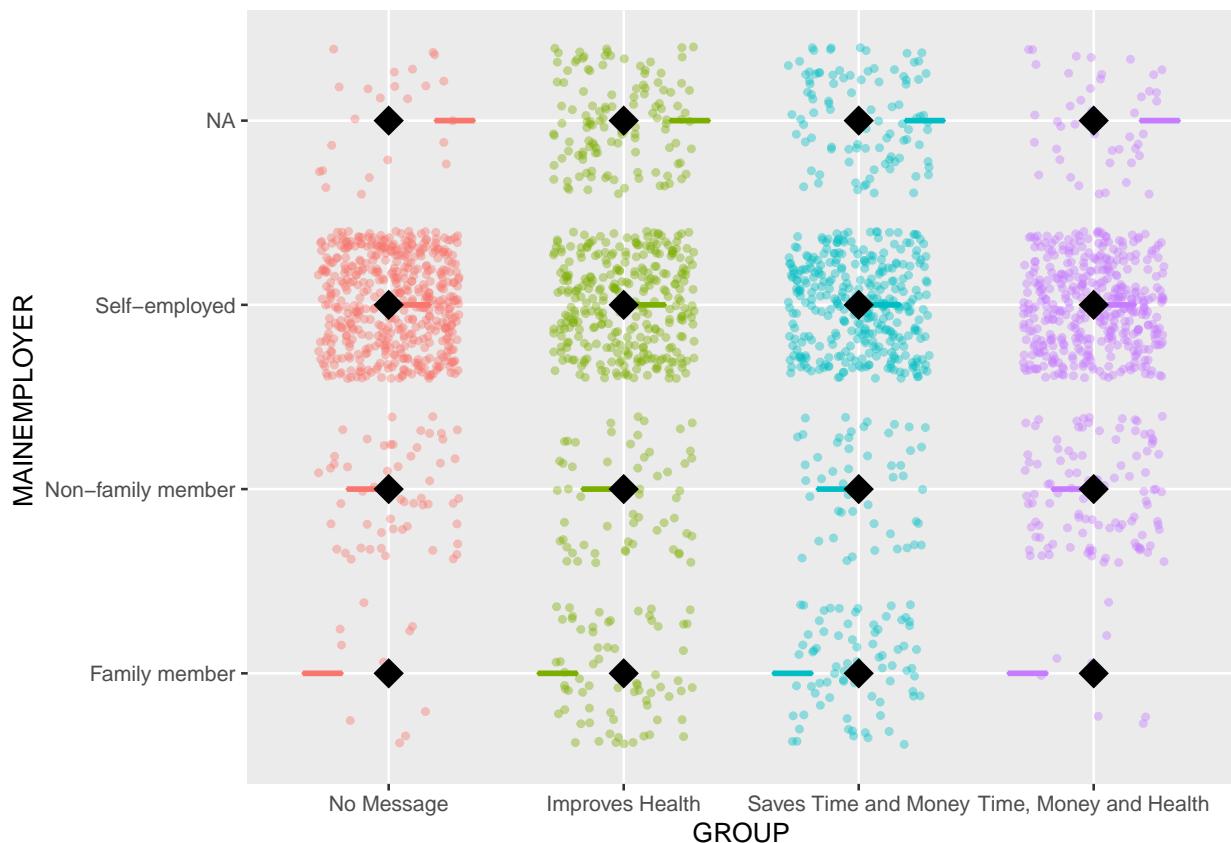
```
##
## Kruskal-Wallis rank sum test
##
## data: RADIO_DUMMY by GROUP
## Kruskal-Wallis chi-squared = 4.3895, df = 3, p-value = 0.2224
```

## 5. SELFEMPLOYED - Visualization on MAINEMPLOYER, test on SELFEMPLOYED

```
### Summary
data=Data[!is.na(Data$SELFEMPLOYED ), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time, Money and Health"))
SELFEMPLOYED_mean <- tapply(as.numeric(data$SELFEMPLOYED ), data$GROUP, mean)
SELFEMPLOYED_sd <- tapply(as.numeric((data$SELFEMPLOYED )), data$GROUP, sd)
n <- tapply(data$SELFEMPLOYED , data$GROUP, length)
data.frame(mean = SELFEMPLOYED_mean, std.dev = SELFEMPLOYED_sd, n = n)
```

	mean	std.dev	n
## No Message	0.8444056	0.3627877	572
## Improves Health	0.5531532	0.4976152	555
## Saves Time and Money	0.5974499	0.4908588	549
## Time, Money and Health	0.7168459	0.4509349	558

```
### Visualization
ggplot(data, aes(GROUP, MAINEMPLOYER , color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "MAINEMPLOYER ") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)
```



```
### Krusal-Wallis test
kruskal.test(SELFEMPLOYED ~ GROUP, data )
```

```
##
## Kruskal-Wallis rank sum test
##
## data: SELFEMPLOYED by GROUP
## Kruskal-Wallis chi-squared = 132.59, df = 3, p-value < 2.2e-16
```

## 6. TIME\_EMPLOYED - Year round employment (share)

```
### Summary
data=Data[!is.na(Data$TIME_EMPLOYED ), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time, Money and Health"))
TIME_EMPLOYED_mean <- tapply(as.numeric(data$TIME_EMPLOYED ), data$GROUP, mean)
```

```

TIME_EMPLOYED_sd <- tapply(as.numeric((data$TIME_EMPLOYED)), data$GROUP, sd)
n <- tapply(data$TIME_EMPLOYED , data$GROUP, length)
data.frame(mean =TIME_EMPLOYED_mean, std.dev = TIME_EMPLOYED_sd, n = n)

```

```

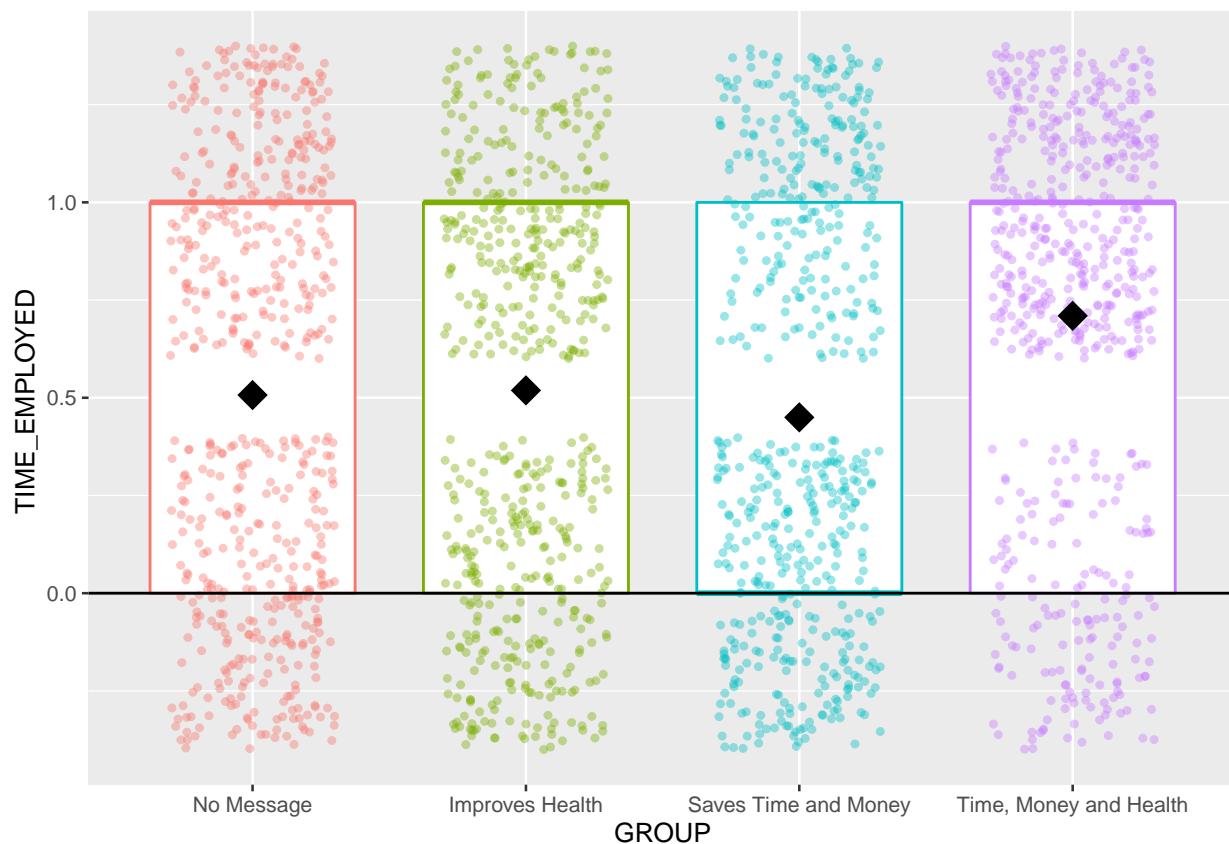
##                                     mean   std.dev   n
## No Message                 0.5069930 0.5003887 572
## Improves Health            0.5189189 0.5000927 555
## Saves Time and Money      0.4499089 0.4979383 549
## Time, Money and Health    0.7096774 0.4543185 558

```

```

### Visualization
ggplot(data, aes(GROUP,TIME_EMPLOYED , color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "TIME_EMPLOYED ") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```

### Krusal-Wallis test
kruskal.test(TIME_EMPLOYED ~ GROUP, data )

```

```

##
## Kruskal-Wallis rank sum test

```

```

##  

## data: TIME_EMPLOYED by GROUP  

## Kruskal-Wallis chi-squared = 85.886, df = 3, p-value < 2.2e-16

```

## 7. COWS

```

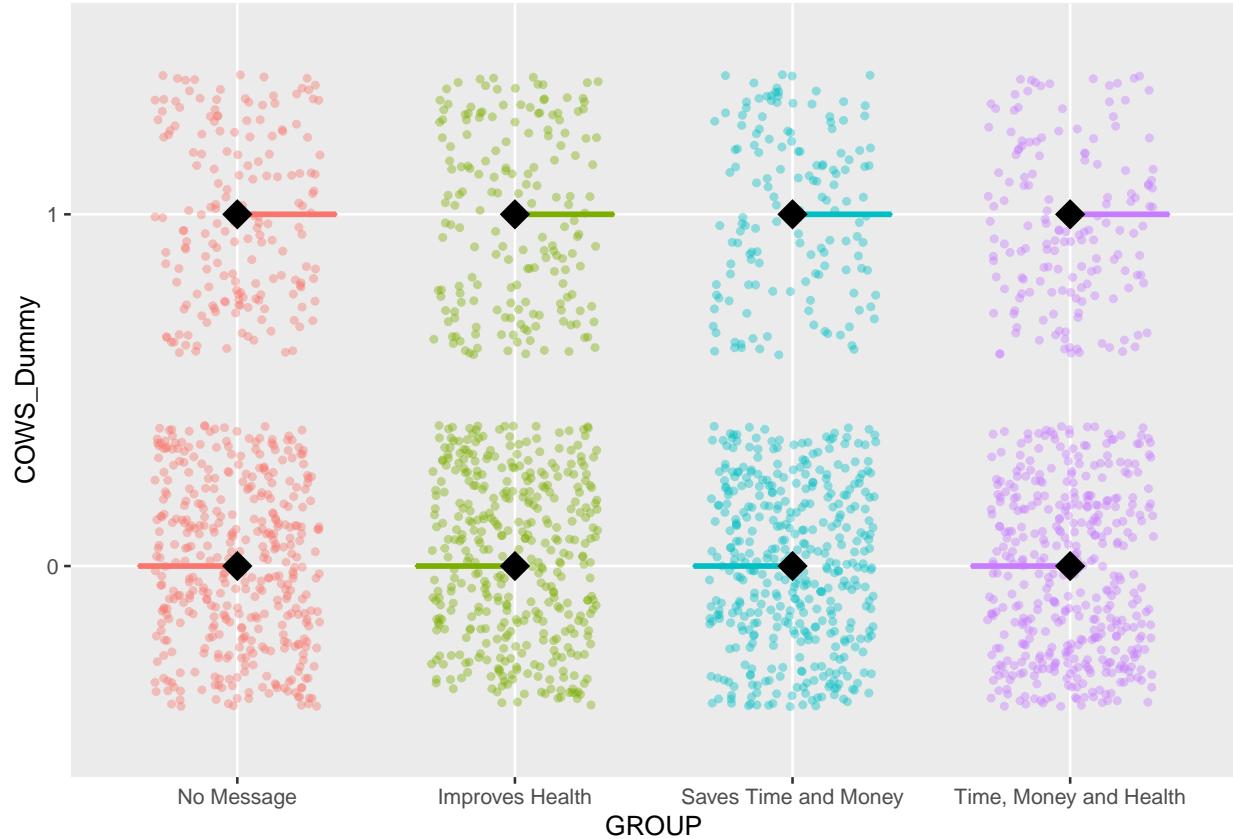
#### Create COWS_Dummy
data=Data[!is.na(Data$COWS), ]
data$COWS_Dummy = data$COWS
data$COWS_Dummy[data$COWS_Dummy == "No"] <- 0
data$COWS_Dummy[data$COWS_Dummy == "Yes"] <- 1
data_plus$COWS_Dummy = data$COWS_Dummy

#### Summary
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time and Money and Health"))
COWS_Dummy_mean <- tapply(as.numeric(data$COWS_Dummy ), data$GROUP, mean)
COWS_Dummy_sd <- tapply(as.numeric((data$COWS_Dummy)), data$GROUP, sd)
n <- tapply(data$COWS_Dummy , data$GROUP, length)
data.frame(mean =COWS_Dummy_mean, std.dev =COWS_Dummy_sd, n = n)

##          mean   std.dev   n
## No Message 0.3070175 0.4616619 570
## Improves Health 0.3153153 0.4650605 555
## Saves Time and Money 0.2655678 0.4420400 546
## Time, Money and Health 0.2818671 0.4503134 557

#### Visualization
ggplot(data, aes(GROUP,COWS_Dummy, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "COWS_Dummy") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```
### Krusal-Wallis test
kruskal.test(COWS_Dummy ~ GROUP, data )
```

```
##
## Kruskal-Wallis rank sum test
##
## data: COWS_Dummy by GROUP
## Kruskal-Wallis chi-squared = 4.1913, df = 3, p-value = 0.2415
```

## 8. TV

```
### Create TV_Dummy
data$TV_Dummy = data$TV
data$TV_Dummy[data$TV_Dummy == "No"] <- 0
data$TV_Dummy[is.na(data$TV_Dummy)] <- 0
data$TV_Dummy[data$TV_Dummy == "Yes"] <- 1
data_plus$TV_Dummy = data$TV_Dummy

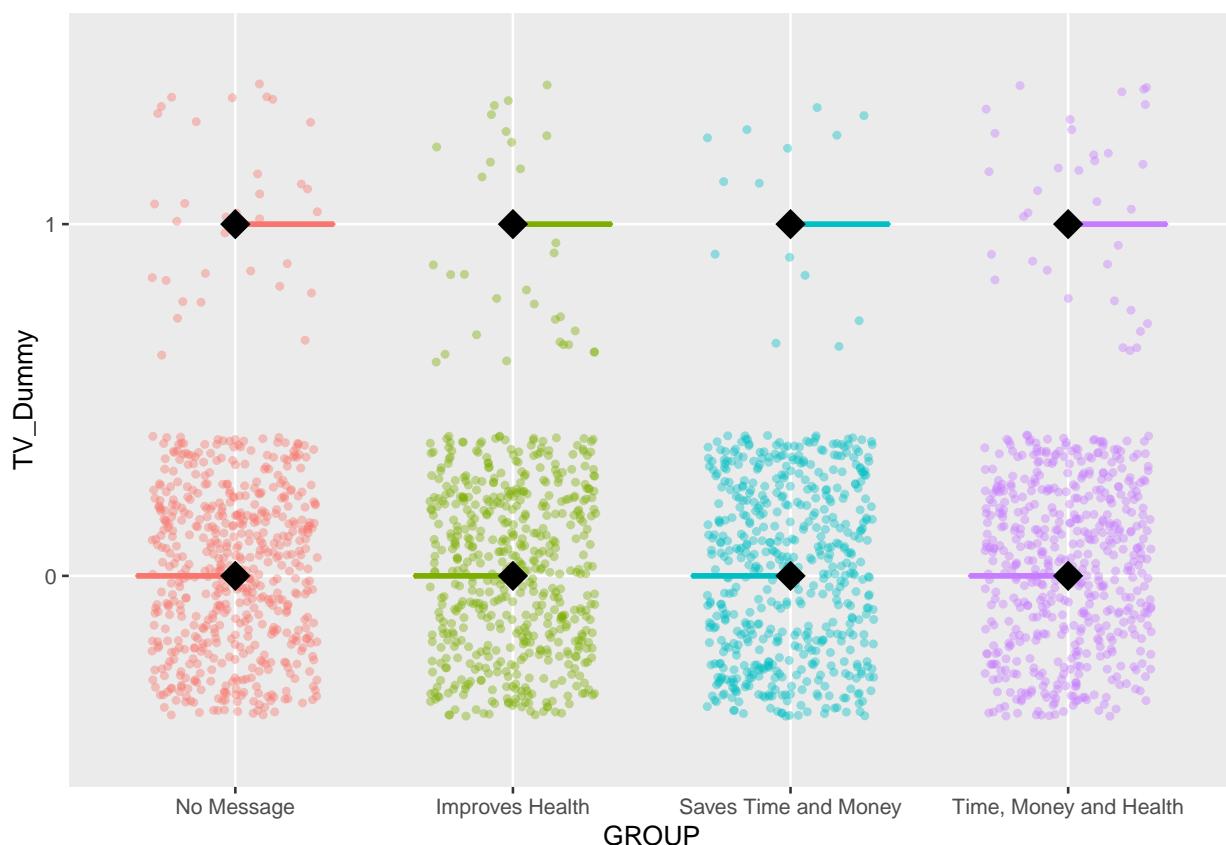
### Summary
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money", "Time, Money and Health"))
TV_Dummy_mean <- tapply(as.numeric(data$TV_Dummy), data$GROUP, mean)
TV_Dummy_sd <- tapply(as.numeric((data$TV_Dummy)), data$GROUP, sd)
n <- tapply(data$TV_Dummy, data$GROUP, length)
data.frame(mean = TV_Dummy_mean, std.dev = TV_Dummy_sd, n = n)
```

```

##                                     mean   std.dev   n
## No Message                  0.05789474 0.2337494 570
## Improves Health              0.05585586 0.2298503 555
## Saves Time and Money        0.02564103 0.1582068 546
## Time, Money and Health     0.06283662 0.2428870 557

### Visualization
ggplot(data, aes(GROUP, TV_Dummy, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "TV_Dummy") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```

### Krusal-Wallis test
kruskal.test(TV_Dummy~ GROUP, data )

```

```

##
##  Kruskal-Wallis rank sum test
##
## data:  TV_Dummy by GROUP
## Kruskal-Wallis chi-squared = 9.7403, df = 3, p-value = 0.02091

```

9. *Total\_Asset - this is computed with all the wealth dummies and durable good prices provided.*

```

### Create TV_Dummy
ASSET_TOTAL = read.csv("ASSET_VALUE.csv")
data_plus$ASSET_TOTAL = ASSET_TOTAL$ASSET
data = data_plus

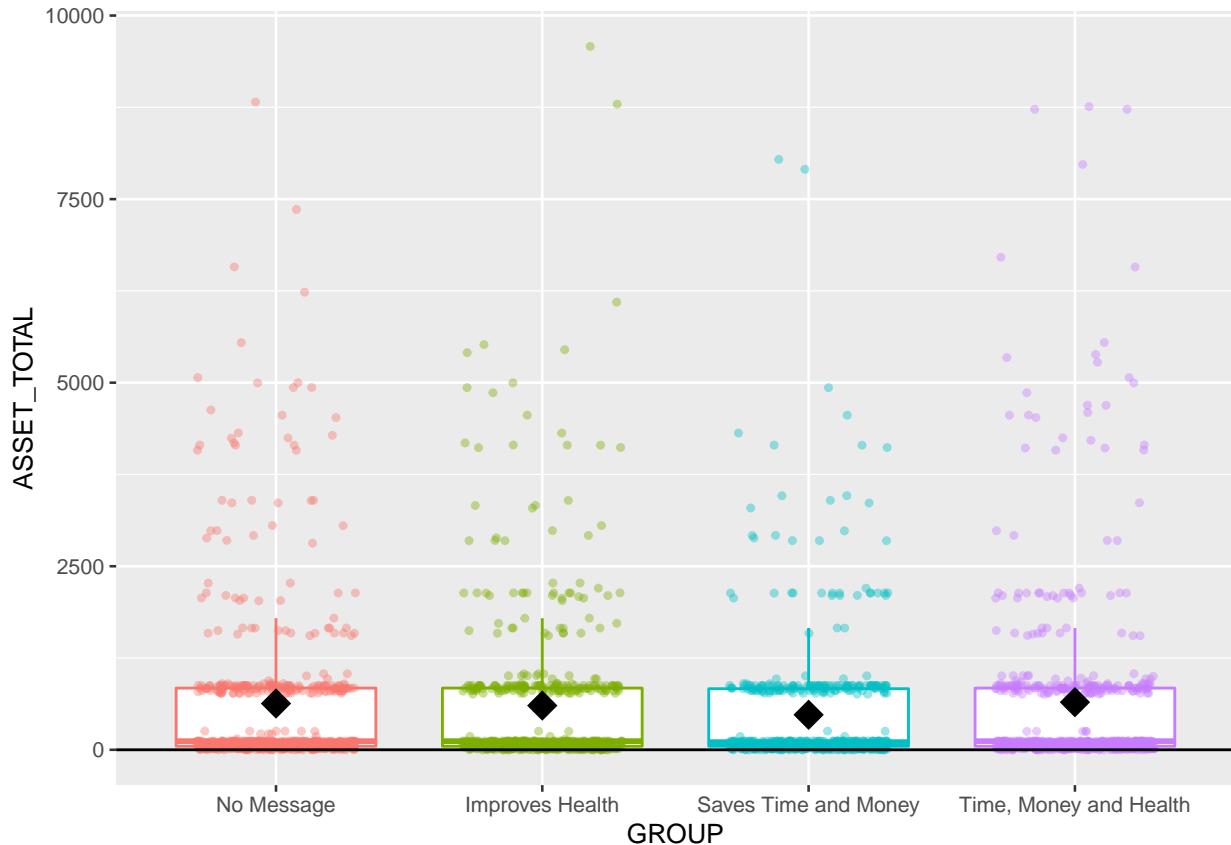
### Summary
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time, Money and Health"))

ASSET_TOTAL_mean <- tapply(data$ASSET_TOTAL, data$GROUP, mean)
ASSET_TOTAL_sd <- tapply(as.numeric((data$ASSET_TOTAL)), data$GROUP, sd)
n <- tapply(data$ASSET_TOTAL , data$GROUP, length)
data.frame(mean =ASSET_TOTAL_mean, std.dev =ASSET_TOTAL_sd, n = n)

##                                     mean   std.dev   n
## No Message           630.0371 1130.5497 570
## Improves Health      602.1494 1088.7792 555
## Saves Time and Money 476.5693  881.9233 546
## Time, Money and Health 647.8504 1242.0216 557

### Visualization
ggplot(data, aes(GROUP,ASSET_TOTAL, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "ASSET_TOTAL") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```
### Krusal-Wallis test
kruskal.test(ASSET_TOTAL~ GROUP, data )
```

```
##
## Kruskal-Wallis rank sum test
##
## data: ASSET_TOTAL by GROUP
## Kruskal-Wallis chi-squared = 4.966, df = 3, p-value = 0.1743
```

### 2.2.3 Cookstove variables - C

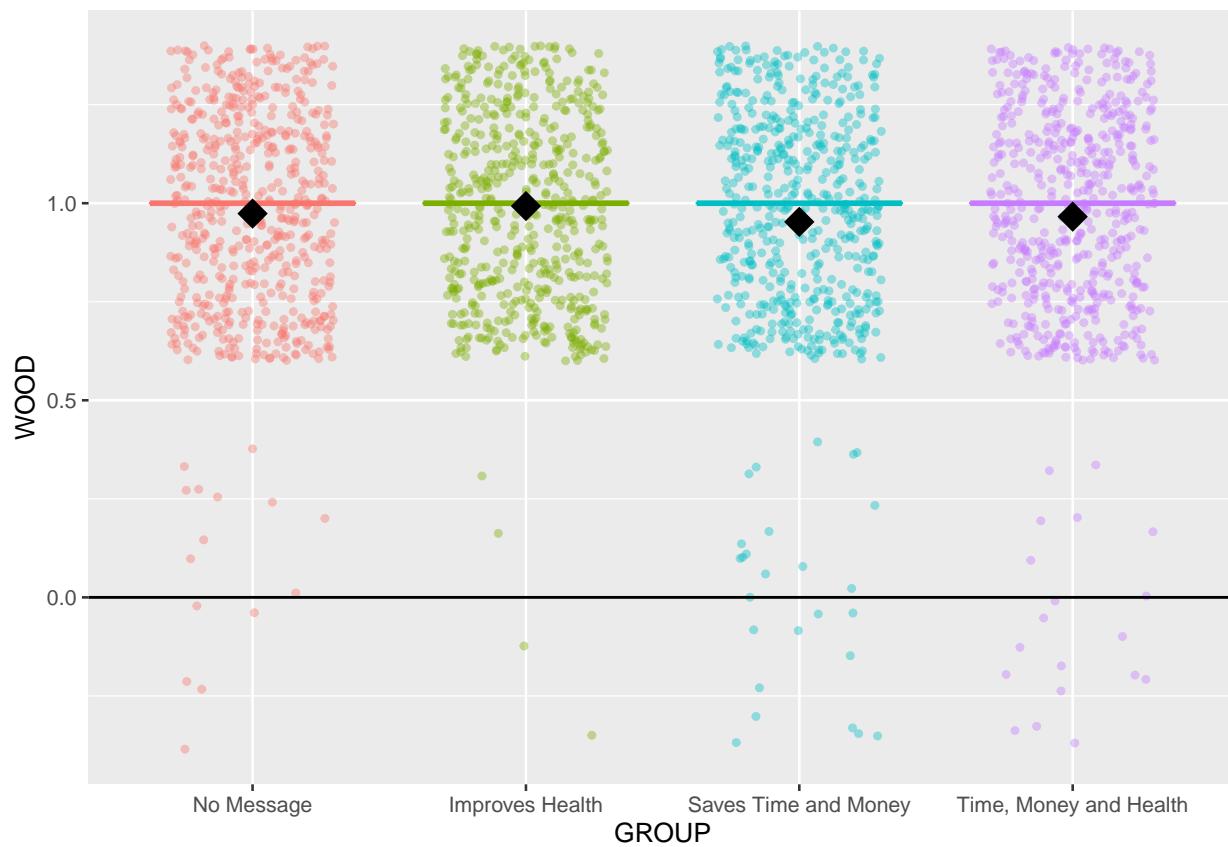
1.WOOD - the dummy of whether wood is the primary fuel.

```
### Summary
data=Data[!is.na(Data$WOOD ), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time, Money and Health"))
WOOD_mean <- tapply(as.numeric(data$WOOD), data$GROUP, mean)
WOOD_sd <- tapply(as.numeric((data$WOOD)), data$GROUP, sd)
n <- tapply(data$WOOD, data$GROUP, length)
data.frame(mean = WOOD_mean, std.dev = WOOD_sd, n = n)
```

	mean	std.dev	n
## No Message	0.9737762	0.1599400	572
## Improves Health	0.9927928	0.0846651	555

```
## Saves Time and Money  0.9526412 0.2125989 549
## Time, Money and Health 0.9659498 0.1815208 558
```

```
### Visualization
ggplot(data, aes(GROUP, WOOD, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "WOOD") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)
```



```
### Kruskal-Wallis test
kruskal.test(WOOD ~ GROUP, data )
```

```
##
##  Kruskal-Wallis rank sum test
##
## data:  WOOD by GROUP
## Kruskal-Wallis chi-squared = 16.774, df = 3, p-value = 0.0007866
```

2. TSF\_PRIMARY - whether a three-stone fire is the primary stove. None means owning a stone stove.  
Test on TSF\_PRIMARY, visualization on STOVES1.

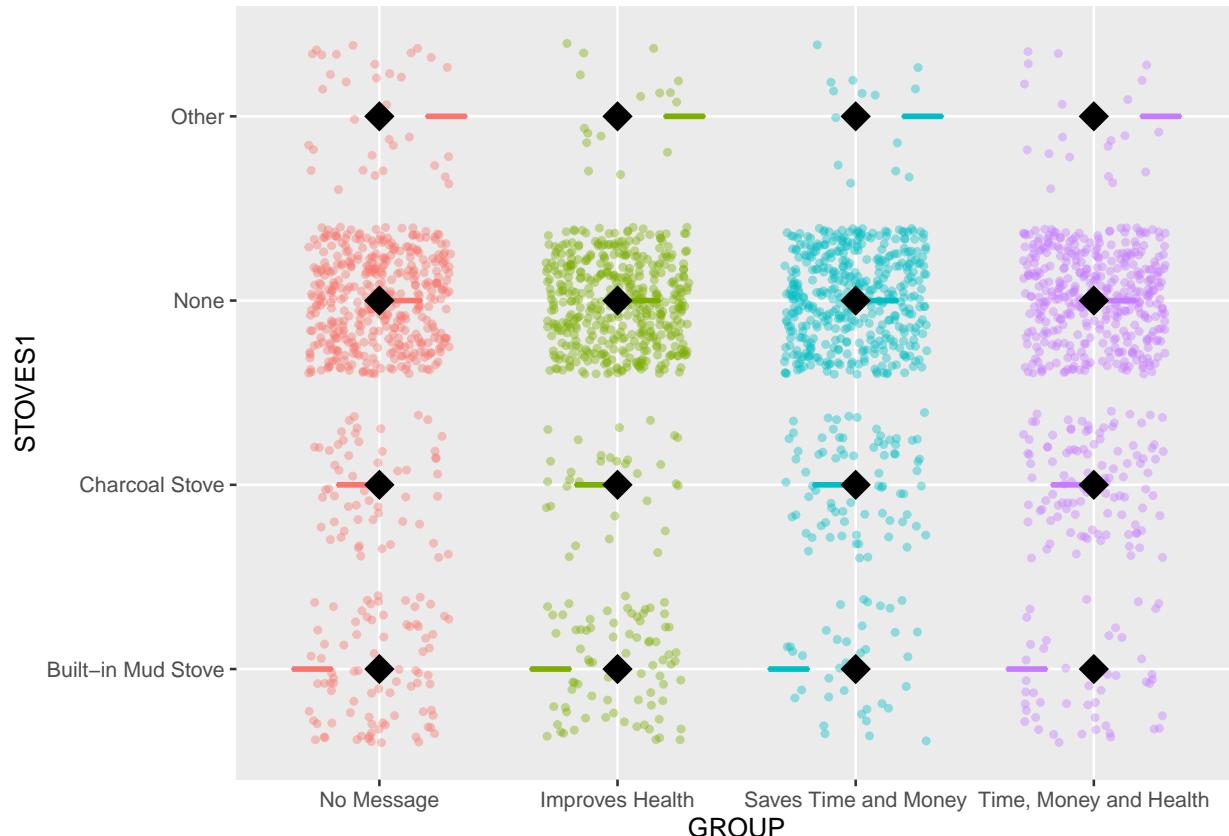
```

### Summary
data=Data[!is.na(Data$STOVES1) , ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money", "Time, Money and Health"))
TSF_PRIMARY_mean <- tapply(as.numeric(data$TSF_PRIMARY), data$GROUP, mean)
TSF_PRIMARY_sd <- tapply(as.numeric((data$TSF_PRIMARY)), data$GROUP, sd)
n <- tapply(data$TSF_PRIMARY, data$GROUP, length)
data.frame(mean = TSF_PRIMARY_mean, std.dev = TSF_PRIMARY_sd, n = n)

##          mean   std.dev    n
## No Message 0.6964912 0.4601768 570
## Improves Health 0.7783784 0.4157125 555
## Saves Time and Money 0.7637363 0.4251756 546
## Time, Money and Health 0.6858169 0.4646070 557

### Visualization
ggplot(data, aes(GROUP, STOVES1, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "STOVES1") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```
### Krusal-Wallis test
kruskal.test(TSF_PRIMARY ~ GROUP, data )
```

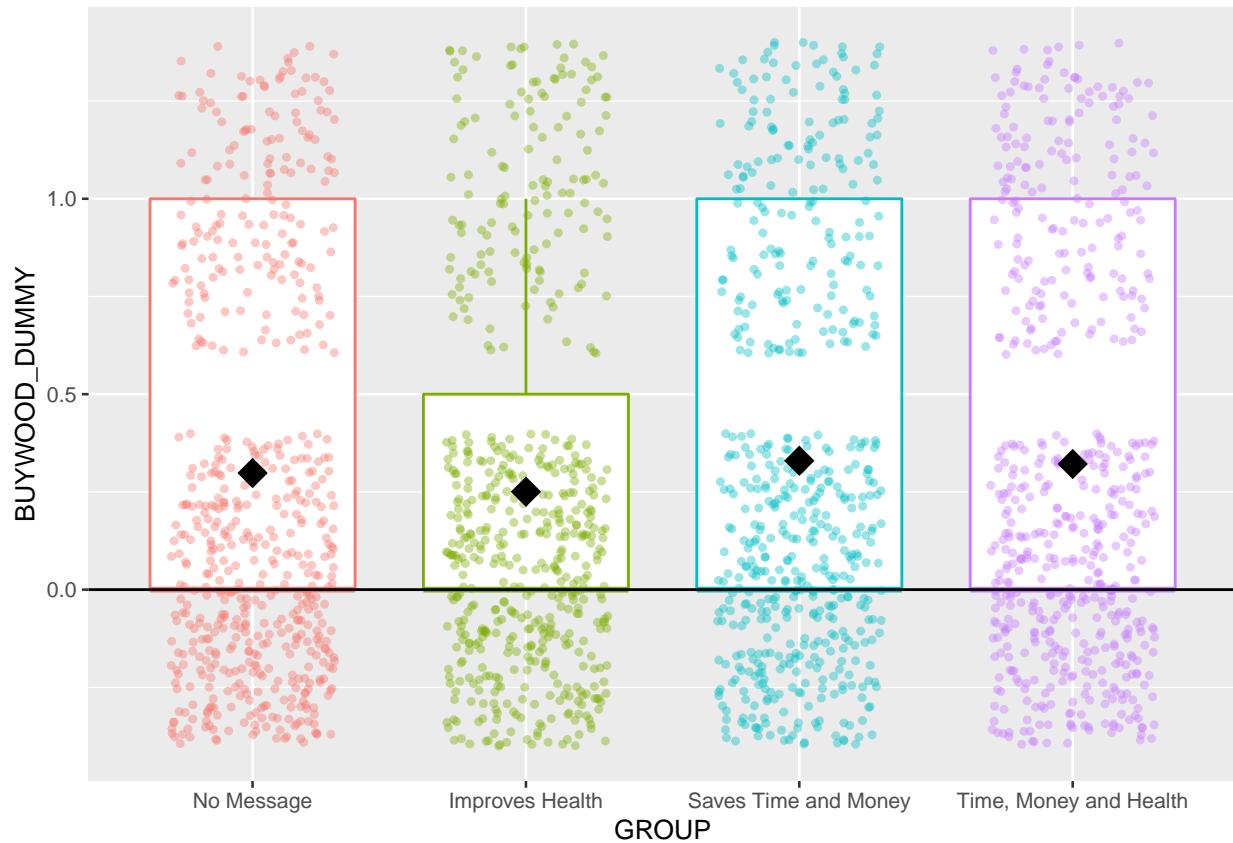
```
##
##  Kruskal-Wallis rank sum test
##
## data: TSF_PRIMARY by GROUP
## Kruskal-Wallis chi-squared = 18.524, df = 3, p-value = 0.000343
```

### 3. BUYWOOD\_DUMMY- buys wood last week or month

```
### Summary
data=Data[!is.na(Data$BUYWOOD_DUMMY ), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time"))
BUYWOOD_DUMMY_mean <- tapply(as.numeric(data$BUYWOOD_DUMMY), data$GROUP, mean)
BUYWOOD_DUMMY_sd <- tapply(as.numeric((data$BUYWOOD_DUMMY)), data$GROUP, sd)
n <- tapply(data$BUYWOOD_DUMMY, data$GROUP, length)
data.frame(mean = BUYWOOD_DUMMY_mean, std.dev = BUYWOOD_DUMMY_sd, n = n)
```

	mean	std.dev	n
## No Message	0.2982456	0.4578897	570
## Improves Health	0.2504505	0.4336633	555
## Saves Time and Money	0.3296703	0.4705245	546
## Time, Money and Health	0.3213645	0.4674201	557

```
### Visualization
ggplot(data, aes(GROUP, BUYWOOD_DUMMY, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "BUYWOOD_DUMMY") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)
```



```
### Krusal-Wallis test
kruskal.test(BUYWOOD_DUMMY ~ GROUP, data )
```

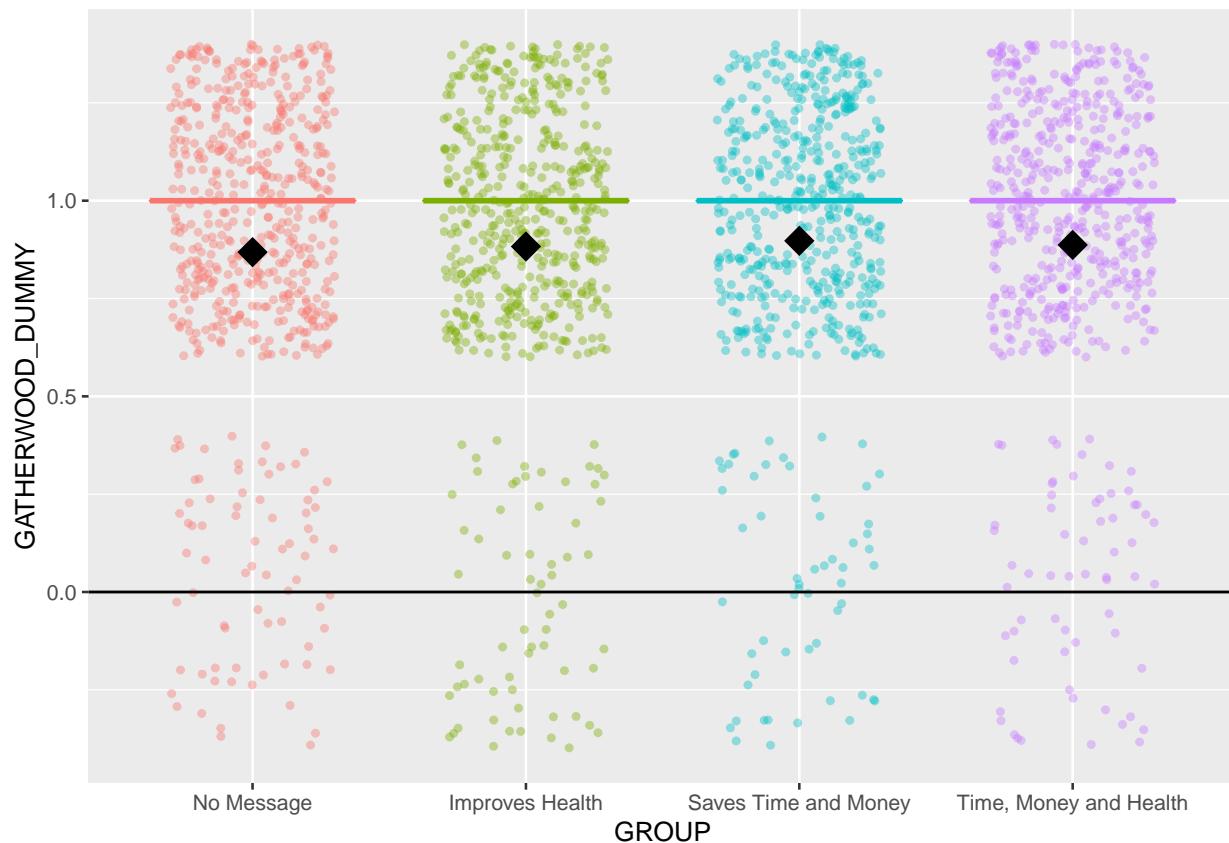
```
##
## Kruskal-Wallis rank sum test
##
## data: BUYWOOD_DUMMY by GROUP
## Kruskal-Wallis chi-squared = 9.9951, df = 3, p-value = 0.01861
```

#### 4. GATHERWOOD\_DUMMY - whether the household gathered wood last week

```
### Summary
data=Data[!is.na(Data$GATHERWOOD_DUMMY ), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time, Money and Health"))
GATHERWOOD_DUMMY_mean <- tapply(as.numeric(data$GATHERWOOD_DUMMY), data$GROUP, mean)
GATHERWOOD_DUMMY_sd <- tapply(as.numeric((data$GATHERWOOD_DUMMY)), data$GROUP, sd)
n <- tapply(data$GATHERWOOD_DUMMY, data$GROUP, length)
data.frame(mean = GATHERWOOD_DUMMY_mean, std.dev = GATHERWOOD_DUMMY_sd, n = n)
```

	mean	std.dev	n
## No Message	0.8684211	0.3383293	570
## Improves Health	0.8828829	0.3218499	555
## Saves Time and Money	0.8974359	0.3036669	546
## Time, Money and Health	0.8868941	0.3170069	557

```
### Visualization
ggplot(data, aes(GROUP, GATHERWOOD_DUMMY, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "GATHERWOOD_DUMMY") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)
```



```
### Kruskal-Wallis test
kruskal.test(GATHERWOOD_DUMMY ~ GROUP, data )
```

```
##
##  Kruskal-Wallis rank sum test
##
##  data:  GATHERWOOD_DUMMY by GROUP
##  Kruskal-Wallis chi-squared = 2.3558, df = 3, p-value = 0.5019
```

## 2.2.4 Dependent variables - Y

### 1. MAXBID

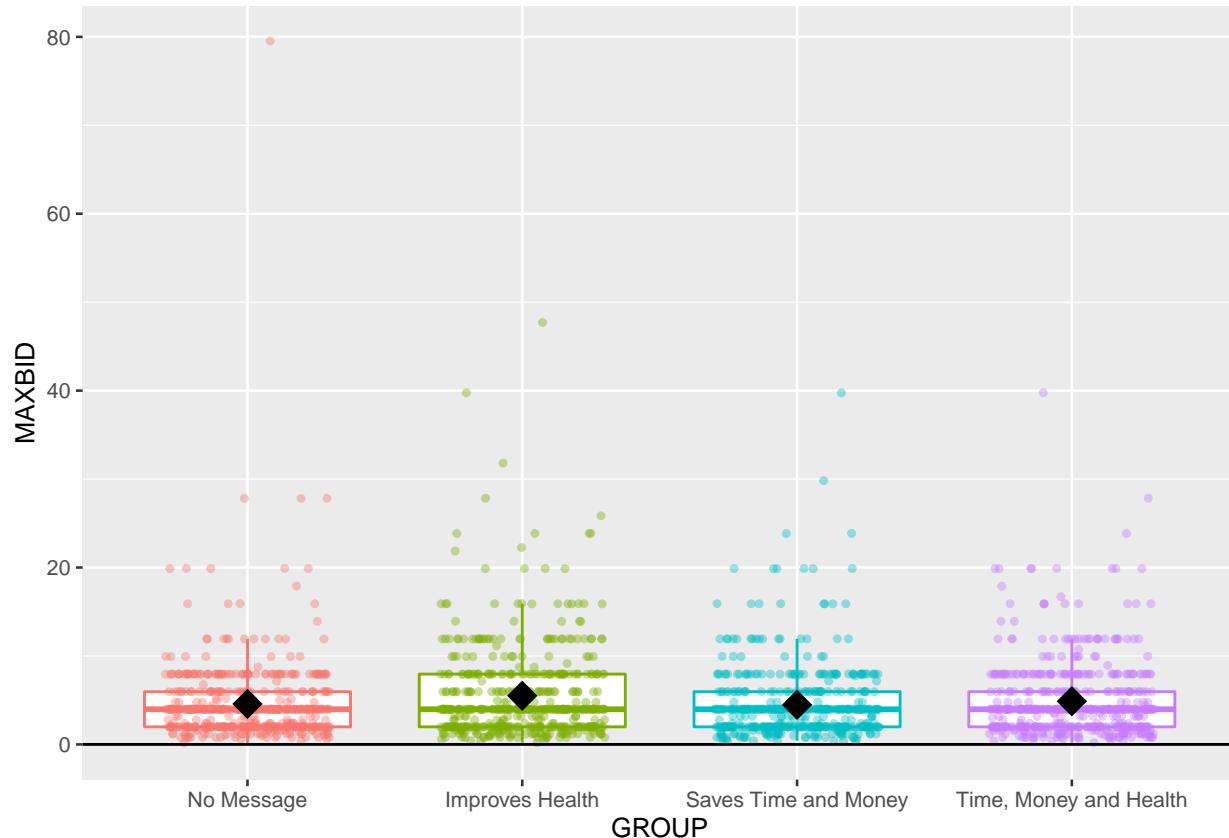
```

### Summary
data=Data[!is.na(Data$MAXBID ), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time, Money and Health"))
MAXBID_mean <- tapply(as.numeric(data$MAXBID), data$GROUP, mean)
MAXBID_sd <- tapply(as.numeric((data$MAXBID)), data$GROUP, sd)
n <- tapply(data$MAXBID, data$GROUP, length)
data.frame(mean = MAXBID_mean, std.dev = MAXBID_sd, n = n)

##                                     mean   std.dev    n
## No Message             4.579009 4.819203 546
## Improves Health        5.503134 5.220355 525
## Saves Time and Money   4.474517 4.135269 513
## Time, Money and Health 4.877390 4.281005 541

### Visualization
ggplot(data, aes(GROUP, MAXBID, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "MAXBID") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```

### Krusal-Wallis test
kruskal.test(MAXBID ~ GROUP, data )

##
##  Kruskal-Wallis rank sum test
##
## data:  MAXBID by GROUP
## Kruskal-Wallis chi-squared = 11.644, df = 3, p-value = 0.008708

```

## 2. MAXBIDNOVEL

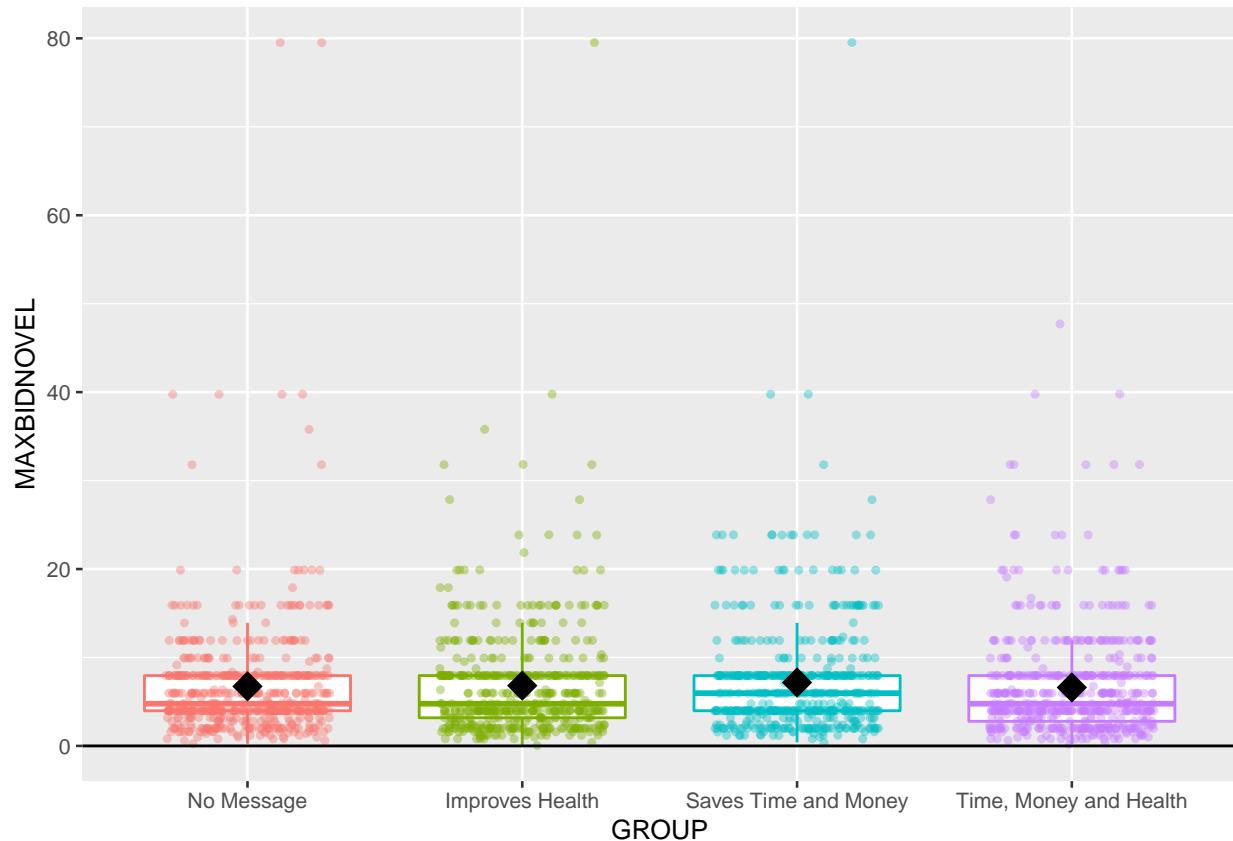
```

### Summary
data=Data[!is.na(Data$MAXBIDNOVEL ), ]
data$GROUP<- factor(data$GROUP, levels = c("No Message", "Improves Health", "Saves Time and Money","Time
MAXBIDNOVEL_mean <- tapply(as.numeric(data$MAXBIDNOVEL), data$GROUP, mean)
MAXBIDNOVEL_sd <- tapply(as.numeric((data$MAXBIDNOVEL)), data$GROUP, sd)
n <- tapply(data$MAXBIDNOVEL, data$GROUP, length)
data.frame(mean = MAXBIDNOVEL_mean, std.dev = MAXBIDNOVEL_sd, n = n)

##               mean std.dev   n
## No Message      6.732729 6.87404 544
## Improves Health 6.815442 6.34957 514
## Saves Time and Money 7.171327 6.37634 535
## Time, Money and Health 6.608321 5.90320 542

### Visualization
ggplot(data, aes(GROUP, MAXBIDNOVEL, color=GROUP)) +
  geom_boxplot(show.legend=FALSE, outlier.shape = NA) +
  geom_jitter(width=0.3, alpha = 0.4, size=0.9, show.legend=FALSE) +
  ylab(label = "MAXBIDNOVEL") +
  stat_summary(fun = "mean", size = 5, geom = "point", shape=18, color = 'black') +
  geom_hline(yintercept = 0) +
  theme_grey(base_size=10)

```



```
### Krusal-Wallis test
kruskal.test(MAXBIDNOVEL ~ GROUP, data )
```

```
##
## Kruskal-Wallis rank sum test
##
## data: MAXBIDNOVEL by GROUP
## Kruskal-Wallis chi-squared = 5.585, df = 3, p-value = 0.1336
```

### 2.3 Full sample - Pooled statistics

```
### Clean the incomplete observations, note: save in a new "data" in lower
data_temp=Data[!is.na(Data$AGE), ]
### Table of descriptive statistics by treatment group
temp_mean <- mean(data_temp$AGE)
temp_sd <- sd(data_temp$AGE)
temp_n <- length(data_temp$AGE)
data.frame(t(c(temp_mean,temp_sd,temp_n)))
```

```
##          X1        X2      X3
## 1 39.42504 13.55844 2228
```

```

data_temp=Data[!is.na(Data$FEMALE) , ]
temp_mean <- mean(data_temp$FEMALE)
temp_sd <- sd(data_temp$FEMALE)
temp_n <- length(data_temp$FEMALE)
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1          X2          X3
## 1 0.7105027 0.4536309 2228

```

```

data_temp=Data[!is.na(Data$MARRIED) , ]
temp_mean <- mean(data_temp$MARRIED)
temp_sd <- sd(data_temp$MARRIED)
temp_n <- length(data_temp$MARRIED)
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1          X2          X3
## 1 0.7945389 0.4041286 2234

```

```

data_temp=Data[!is.na(Data$WIFECOOK) , ]
temp_mean <- mean(data_temp$WIFECOOK)
temp_sd <- sd(data_temp$WIFECOOK)
temp_n <- length(data_temp$WIFECOOK)
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1          X2          X3
## 1 0.8697404 0.3366642 2234

```

```

data_temp=Data[!is.na(Data$JOINTDECISION) , ]
temp_mean <- mean(data_temp$JOINTDECISION)
temp_sd <- sd(data_temp$JOINTDECISION)
temp_n <- length(data_temp$JOINTDECISION)
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1          X2          X3
## 1 0.4431513 0.4968689 2234

```

```

data_temp=data_plus[!is.na(data_plus$KNOWLUNCH_Dummy) , ]
temp_mean <- mean(data_temp$KNOWLUNCH_Dummy)
temp_sd <- sd(data_temp$KNOWLUNCH_Dummy)
temp_n <- length(data_temp$KNOWLUNCH_Dummy)
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1          X2          X3
## 1 0.8958707 0.3054967 2228

```

```

data_temp=Data[!is.na(Data$LUNCHYESTERDAY) , ]
temp_mean <- mean(data_temp$LUNCHYESTERDAY)
temp_sd <- sd(data_temp$LUNCHYESTERDAY)
temp_n <- length(data_temp$LUNCHYESTERDAY)
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1          X2          X3
## 1 4.533801 2.335893 1997

data_temp=data_plus[!is.na(data_plus$TYPICALNUMEATING_Dummy), ]
temp_mean <- mean(as.numeric(data_temp$TYPICALNUMEATING_Dummy))
temp_sd <- sd(as.numeric(data_temp$TYPICALNUMEATING_Dummy))
temp_n <- length(as.numeric(data_temp$TYPICALNUMEATING_Dummy))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1          X2          X3
## 1 0.5102654 0.5000198 1997

data_temp=data_plus[!is.na(data_plus$CASHPAID_Dummy), ]
temp_mean <- mean(as.numeric(data_temp$CASHPAID_Dummy))
temp_sd <- sd(as.numeric(data_temp$CASHPAID_Dummy))
temp_n <- length(data_temp$CASHPAID_Dummy)
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1          X2          X3
## 1 0.9897646 0.1006769 1954

data_temp=data_plus[!is.na(data_plus$ASSET_TOTAL), ]
temp_mean <- mean(data_temp$ASSET_TOTAL)
temp_sd <- sd(data_temp$ASSET_TOTAL)
temp_n <- length(data_temp$ASSET_TOTAL)
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1          X2          X3
## 1 589.9343 1096.075 2228

data_temp=Data[!is.na(Data$HH_PHONES), ]
temp_mean <- mean(data_temp$HH_PHONES)
temp_sd <- sd(data_temp$HH_PHONES)
temp_n <- length(data_temp$HH_PHONES)
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1          X2          X3
## 1 0.8719785 0.6776404 2234

data_temp=data_plus[!is.na(data_plus$INCOME_Dummy), ]
temp_mean <- mean(as.numeric(data_temp$INCOME_Dummy))
temp_sd <- sd(as.numeric(data_temp$INCOME_Dummy))
temp_n <- length(as.numeric(data_temp$INCOME_Dummy))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1          X2          X3
## 1 0.8743268 0.3315552 2228

```

```

data_temp=Data[!is.na(Data$BICYCLE_DUMMY), ]
temp_mean <- mean(as.numeric(data_temp$BICYCLE_DUMMY))
temp_sd <- sd(as.numeric(data_temp$BICYCLE_DUMMY))
temp_n <- length(as.numeric(data_temp$BICYCLE_DUMMY))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1      X2      X3
## 1 0.4896861 0.5000057 2230

```

```

data_temp=Data[!is.na(Data$CAR_DUMMY), ]
temp_mean <- mean(as.numeric(data_temp$CAR_DUMMY))
temp_sd <- sd(as.numeric(data_temp$CAR_DUMMY))
temp_n <- length(as.numeric(data_temp$CAR_DUMMY))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1      X2      X3
## 1 0.01524664 0.1225598 2230

```

```

data_temp=Data[!is.na(Data$MOTORCYCLE_DUMMY), ]
temp_mean <- mean(as.numeric(data_temp$MOTORCYCLE_DUMMY))
temp_sd <- sd(as.numeric(data_temp$MOTORCYCLE_DUMMY))
temp_n <- length(as.numeric(data_temp$MOTORCYCLE_DUMMY))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1      X2      X3
## 1 0.1071749 0.3094048 2230

```

```

data_temp=Data[!is.na(Data$RADIO_DUMMY), ]
temp_mean <- mean(as.numeric(data_temp$RADIO_DUMMY))
temp_sd <- sd(as.numeric(data_temp$RADIO_DUMMY))
temp_n <- length(as.numeric(data_temp$RADIO_DUMMY))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1      X2      X3
## 1 0.8891382 0.3140314 2228

```

```

data_temp=Data[!is.na(data_plus$SELFEMPLOYED ), ]
temp_mean <- mean(as.numeric(data_temp$SELFEMPLOYED ))
temp_sd <- sd(as.numeric(data_temp$SELFEMPLOYED ))
temp_n <- length(as.numeric(data_temp$SELFEMPLOYED ))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1      X2      X3
## 1 0.6794987 0.4667738 2234

```

```

data_temp=Data[!is.na(Data$TIME_EMPLOYED), ]
temp_mean <- mean(as.numeric(data_temp$TIME_EMPLOYED))
temp_sd <- sd(as.numeric(data_temp$TIME_EMPLOYED))
temp_n <- length(as.numeric(data_temp$TIME_EMPLOYED))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

```

```

##          X1          X2          X3
## 1 0.5465533 0.4979395 2234

data_temp=data_plus[!is.na(data_plus$COWS_Dummy), ]
temp_mean <- mean(as.numeric(data_temp$COWS_Dummy))
temp_sd <- sd(as.numeric(data_temp$COWS_Dummy))
temp_n <- length(as.numeric(data_temp$COWS_Dummy))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1          X2          X3
## 1 0.2926391 0.4550763 2228

data_temp=data_plus[!is.na(data_plus$TV_Dummy), ]
temp_mean <- mean(as.numeric(data_temp$TV_Dummy))
temp_sd <- sd(as.numeric(data_temp$TV_Dummy))
temp_n <- length(as.numeric(data_temp$TV_Dummy))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1          X2          X3
## 1 0.05071813 0.2194708 2228

data_temp=Data[!is.na(Data$WOOD), ]
temp_mean <- mean(as.numeric(data_temp$WOOD))
temp_sd <- sd(as.numeric(data_temp$WOOD))
temp_n <- length(as.numeric(data_temp$WOOD))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1          X2          X3
## 1 0.9713518 0.166853 2234

data_temp=Data[!is.na(Data$TSF_PRIMARY), ]
temp_mean <- mean(as.numeric(data_temp$TSF_PRIMARY))
temp_sd <- sd(as.numeric(data_temp$TSF_PRIMARY))
temp_n <- length(as.numeric(data_temp$TSF_PRIMARY))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1          X2          X3
## 1 0.7287377 0.4447107 2234

data_temp=Data[!is.na(Data$BUYWOOD_DUMMY), ]
temp_mean <- mean(as.numeric(data_temp$BUYWOOD_DUMMY))
temp_sd <- sd(as.numeric(data_temp$BUYWOOD_DUMMY))
temp_n <- length(as.numeric(data_temp$BUYWOOD_DUMMY))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1          X2          X3
## 1 0.2998205 0.458282 2228

```

```

data_temp=Data[!is.na(Data$GATHERWOOD_DUMMY), ]
temp_mean <- mean(as.numeric(data_temp$GATHERWOOD_DUMMY))
temp_sd <- sd(as.numeric(data_temp$GATHERWOOD_DUMMY))
temp_n <- length(as.numeric(data_temp$GATHERWOOD_DUMMY))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1      X2      X3
## 1 0.8837522 0.3205937 2228

data_temp=Data[!is.na(Data$MAXBID ), ]
temp_mean <- mean(as.numeric(data_temp$MAXBID ))
temp_sd <- sd(as.numeric(data_temp$MAXBID ))
temp_n <- length(as.numeric(data_temp$MAXBID ))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1      X2      X3
## 1 4.858061 4.650002 2125

data_temp=Data[!is.na(Data$MAXBIDNOVEL), ]
temp_mean <- mean(as.numeric(data_temp$MAXBIDNOVEL))
temp_sd <- sd(as.numeric(data_temp$MAXBIDNOVEL))
temp_n <- length(as.numeric(data_temp$MAXBIDNOVEL))
data.frame(t(c(temp_mean,temp_sd,temp_n)))

##          X1      X2      X3
## 1 6.830965 6.384978 2135

```

## 2.4 Balance Joint Test (Pairwise F-Test) - TBD

A more robust test is conducted here. We perform pairwise tests, as follows

$$Message_i = \alpha + \gamma' X_i + \epsilon_i$$

i=0,1 denotes the two compared groups. We will totally do 6 tests, pairwisely, and see the F-stat.

```

### Create group dummies
data_plus$No_message = ifelse(data_plus$GROUP == "No Message", 1, 0)
data_plus$Improves_Health = ifelse(data_plus$GROUP == "Improves Health", 1, 0)
data_plus$Time_Money_Health = ifelse(data_plus$GROUP == "Time, Money and Health", 1, 0)
data_plus$Time_Money= ifelse(data_plus$GROUP == "Saves Time and Money", 1, 0)
data_plus = data.frame(data_plus,stringsAsFactors = FALSE)

```

### 2.4.1 Test of socioecon characteristics randomization

No message vs Time and money

```

### No message vs Improves Health
Joint_Test1 = data_plus[ which(data_plus$No_message == 1 | data_plus$Improves_Health == 1),]
lm_JT1= lm(Improves_Health ~ FEMALE+AGE+MARRIED+WIFECOOK+KNOWLUNCH_Dummy+LUNCHYESTERDAY, data=Joint_Test1)

summary(lm_JT1)

```

```

## 
## Call:
## lm(formula = Improves_Health ~ FEMALE + AGE + MARRIED + WIFECOOK +
##      KNOWLUNCH_Dummy + LUNCHYESTERDAY, data = Joint_Test1)
## 
## Residuals:
##    Min     1Q   Median     3Q    Max 
## -0.6415 -0.5123  0.3838  0.4801  0.7040 
## 
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)    
## (Intercept) -0.237846  0.502231 -0.474  0.63590  
## FEMALE       -0.031472  0.035332 -0.891  0.37326  
## AGE          0.002344  0.001138  2.059  0.03973 *  
## MARRIED      -0.001735  0.041355 -0.042  0.96654  
## WIFECOOK      0.160506  0.054053  2.969  0.00305 ** 
## KNOWLUNCH_Dummy 0.547868  0.499360  1.097  0.27283  
## LUNCHYESTERDAY -0.002957  0.006635 -0.446  0.65592  
## --- 
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 
## 
## Residual standard error: 0.4977 on 1068 degrees of freedom
##   (50 observations deleted due to missingness)
## Multiple R-squared:  0.01521,   Adjusted R-squared:  0.009681 
## F-statistic:  2.75 on 6 and 1068 DF,  p-value: 0.01174

```

No message vs Time, Money and Health

```

### Improves Health vs Time, Money and Health
Joint_Test2 = data_plus[ which(data_plus$No_message == 1 | data_plus$Time_Money == 1),]
lm_JT2= lm(Time_Money ~ FEMALE+AGE+MARRIED+WIFECOOK+KNOWLUNCH_Dummy+LUNCHYESTERDAY, data=Joint_Test2)

summary(lm_JT2)

```

```

## 
## Call:
## lm(formula = Time_Money ~ FEMALE + AGE + MARRIED + WIFECOOK +
##      KNOWLUNCH_Dummy + LUNCHYESTERDAY, data = Joint_Test2)
## 
## Residuals:
##    Min     1Q   Median     3Q    Max 
## -0.4867 -0.4830 -0.2802  0.5167  0.7802 
## 
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)    
## (Intercept) -0.0617783  0.4948731 -0.125  0.901  
## FEMALE       0.2031303  0.0412483  4.925  1e-06 *** 
## AGE          0.0000875  0.0012825  0.068  0.946  
## MARRIED      0.0019379  0.0416011  0.047  0.963  
## WIFECOOK      0.0569619  0.0547172  1.041  0.298  
## KNOWLUNCH_Dummy 0.2812015  0.4910757  0.573  0.567  
## LUNCHYESTERDAY -0.0001841  0.0069095 -0.027  0.979  
## --- 
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 
## 
```

```

## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4889 on 926 degrees of freedom
##   (183 observations deleted due to missingness)
## Multiple R-squared:  0.03364,   Adjusted R-squared:  0.02738
## F-statistic: 5.373 on 6 and 926 DF,  p-value: 1.814e-05

```

NO message vs Time money and health

```

Joint_Test3 = data_plus[ which(data_plus$No_message == 1 | data_plus$Time_Money_Health == 1),]
lm_JT3 = lm(Time_Money_Health ~ FEMALE+AGE+MARRIED+WIFECOOK+KNOWLUNCH_Dummy+LUNCHYESTERDAY, data=Joint_Test3)

summary(lm_JT3)

##
## Call:
## lm(formula = Time_Money_Health ~ FEMALE + AGE + MARRIED + WIFECOOK +
##       KNOWLUNCH_Dummy + LUNCHYESTERDAY, data = Joint_Test3)
##
## Residuals:
##    Min      1Q  Median      3Q     Max 
## -0.6283 -0.4938 -0.3586  0.4972  0.6816 
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)    
## (Intercept) -0.053630  0.504054 -0.106  0.9153    
## FEMALE        0.038891  0.037215  1.045  0.2962    
## AGE           0.001340  0.001184  1.131  0.2581    
## MARRIED       0.077294  0.041301  1.871  0.0616 .  
## WIFECOOK      -0.055021  0.049380 -1.114  0.2654    
## KNOWLUNCH_Dummy 0.523631  0.501072  1.045  0.2963    
## LUNCHYESTERDAY -0.015535  0.006928 -2.243  0.0251 *  
## ---      
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4993 on 1040 degrees of freedom
##   (80 observations deleted due to missingness)
## Multiple R-squared:  0.00928,   Adjusted R-squared:  0.003564
## F-statistic: 1.624 on 6 and 1040 DF,  p-value: 0.1372

```

## 2.4.2 Randomization of wealth characteristic

No message vs Improve health

```

Joint_Test4 = data_plus[ which(data_plus$No_message == 1 | data_plus$Improves_Health == 1),]

lm_JT4 = lm(Improves_Health ~ HH_PHONES+BICYCLE_DUMMY+CAR_DUMMY+MOTORCYCLE_DUMMY+RADIO_DUMMY+TIME_EMPLOYED
summary(lm_JT4)

##
## Call:
## lm(formula = Improves_Health ~ HH_PHONES + BICYCLE_DUMMY + CAR_DUMMY + 
##       MOTORCYCLE_DUMMY + RADIO_DUMMY + TIME_EMPLOYED)
## 
```

```

##      MOTORCYCLE_DUMMY + RADIO_DUMMY + TIME_EMPLOYED + COWS_Dummy +
##      TV_Dummy, data = Joint_Test4)
##
## Residuals:
##      Min     1Q   Median     3Q    Max
## -0.5777 -0.4936 -0.4001  0.5058  0.6333
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.544324  0.050543 10.769 <2e-16 ***
## HH_PHONES   -0.057063  0.022310 -2.558  0.0107 *
## BICYCLE_DUMMY 0.008181  0.031180  0.262  0.7931
## CAR_DUMMY   -0.013788  0.133431 -0.103  0.9177
## MOTORCYCLE_DUMMY -0.044633  0.049933 -0.894  0.3716
## RADIO_DUMMY  -0.018914  0.051999 -0.364  0.7161
## TIME_EMPLOYED 0.017728  0.030759  0.576  0.5645
## COWS_Dummy1   0.025224  0.033932  0.743  0.4574
## TV_Dummy1     0.021502  0.069591  0.309  0.7574
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5001 on 1116 degrees of freedom
## Multiple R-squared:  0.00753,   Adjusted R-squared:  0.0004154
## F-statistic: 1.058 on 8 and 1116 DF,  p-value: 0.3901

```

No message vs Time and money

```

Joint_Test5 = data_plus[ which(data_plus$No_message == 1 | data_plus$Time_Money == 1), ]
lm_JT5 = lm(Time_Money ~ BICYCLE_DUMMY+CAR_DUMMY+MOTORCYCLE_DUMMY+RADIO_DUMMY+TIME_EMPLOYED+COWS_Dummy+
summary(lm_JT5)

##
## Call:
## lm(formula = Time_Money ~ BICYCLE_DUMMY + CAR_DUMMY + MOTORCYCLE_DUMMY +
##      RADIO_DUMMY + TIME_EMPLOYED + COWS_Dummy + TV_Dummy, data = Joint_Test5)
##
## Residuals:
##      Min     1Q   Median     3Q    Max
## -0.6092 -0.5007 -0.2536  0.4950  0.7924
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.58020  0.04649 12.481 <2e-16 ***
## BICYCLE_DUMMY 0.02900  0.03122  0.929  0.353
## CAR_DUMMY   -0.11964  0.15346 -0.780  0.436
## MOTORCYCLE_DUMMY -0.07357  0.05126 -1.435  0.152
## RADIO_DUMMY  -0.07065  0.04908 -1.440  0.150
## TIME_EMPLOYED -0.03787  0.03045 -1.244  0.214
## COWS_Dummy1   -0.03354  0.03436 -0.976  0.329
## TV_Dummy1     -0.13995  0.07771 -1.801  0.072 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

## 
## Residual standard error: 0.4978 on 1108 degrees of freedom
## Multiple R-squared:  0.01528,   Adjusted R-squared:  0.009056 
## F-statistic: 2.456 on 7 and 1108 DF,  p-value: 0.01679

# +WOOD+TSF_PRIMARY+BUYWOOD_DUMMY+GATHERWOOD_DUMMY+MAXBID+MAXBIDNOVEL

```

No message vs Time and money and health

```

Joint_Test6 = data_plus[ which(data_plus$No_message == 1 | data_plus$Time_Money_Health == 1),]

lm_JT6 = lm(Time_Money_Health ~ BICYCLE_DUMMY+CAR_DUMMY+MOTORCYCLE_DUMMY+RADIO_DUMMY+COWS_Dummy+TV_Dummy,
summary(lm_JT6)

## 
## Call:
## lm(formula = Time_Money_Health ~ BICYCLE_DUMMY + CAR_DUMMY +
##     MOTORCYCLE_DUMMY + RADIO_DUMMY + COWS_Dummy + TV_Dummy, data = Joint_Test6)
## 
## Residuals:
##       Min     1Q Median     3Q    Max 
## -0.6822 -0.4849 -0.4333  0.5151  0.5667 
## 
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)    
## (Intercept) 0.56678   0.04639 12.217 <2e-16 ***
## BICYCLE_DUMMY -0.01528   0.03106 -0.492   0.6228  
## CAR_DUMMY     0.18196   0.10694  1.702   0.0891 .  
## MOTORCYCLE_DUMMY -0.02579   0.04748 -0.543   0.5872  
## RADIO_DUMMY    -0.06657   0.04949 -1.345   0.1789  
## COWS_Dummy1    -0.02582   0.03388 -0.762   0.4462  
## TV_Dummy1      0.01811   0.06664  0.272   0.7858  
## --- 
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 0.5 on 1120 degrees of freedom
## Multiple R-squared:  0.005952,   Adjusted R-squared:  0.0006264 
## F-statistic: 1.118 on 6 and 1120 DF,  p-value: 0.3497

```

### 2.4.3 Randomization of cookstove related variables

No message vs Time money and health

```

Joint_Test7 = data_plus[ which(data_plus$No_message == 1 | data_plus$Time_Money_Health == 1),]

lm_JT7 = lm(Time_Money_Health ~ WOOD+TSF_PRIMARY+BUYWOOD_DUMMY+GATHERWOOD_DUMMY , data=Joint_Test7)
summary(lm_JT7)

## 
## Call:
## lm(formula = Time_Money_Health ~ WOOD + TSF_PRIMARY + BUYWOOD_DUMMY +
##     GATHERWOOD_DUMMY, data = Joint_Test7)

```

```

##
## Residuals:
##      Min     1Q Median     3Q    Max
## -0.6783 -0.4829 -0.3919  0.5171  0.6081
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)            0.545562  0.091744  5.947 3.65e-09 ***
## WOOD                  -0.144654  0.098235 -1.473  0.1412
## TSF_PRIMARY           -0.009047  0.033093 -0.273  0.7846
## BUYWOOD_DUMMY         0.050750  0.034739  1.461  0.1443
## GATHERWOOD_DUMMY     0.091031  0.051470  1.769  0.0772 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5 on 1122 degrees of freedom
## Multiple R-squared:  0.004327, Adjusted R-squared:  0.0007773
## F-statistic: 1.219 on 4 and 1122 DF, p-value: 0.3009

```

No message vs Time money

```

Joint_Test8 = data_plus[ which(data_plus$No_message == 1 | data_plus$Time_Money == 1),]

lm_JT8 = lm(Time_Money~WOOD+TSF_PRIMARY+BUYWOOD_DUMMY+GATHERWOOD_DUMMY , data=Joint_Test8)
summary(lm_JT8)

```

```

##
## Call:
## lm(formula = Time_Money ~ WOOD + TSF_PRIMARY + BUYWOOD_DUMMY +
##     GATHERWOOD_DUMMY, data = Joint_Test8)
##
## Residuals:
##      Min     1Q Median     3Q    Max
## -0.7762 -0.4964 -0.3765  0.5036  0.6914
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)            0.52061   0.09041  5.758  1.1e-08 ***
## WOOD                  -0.21198   0.08602 -2.464   0.0139 *
## TSF_PRIMARY           0.08625   0.03427  2.517   0.0120 *
## BUYWOOD_DUMMY         0.06784   0.03438  1.973   0.0487 *
## GATHERWOOD_DUMMY     0.10151   0.05093  1.993   0.0465 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4972 on 1111 degrees of freedom
## Multiple R-squared:  0.01497, Adjusted R-squared:  0.01143
## F-statistic: 4.222 on 4 and 1111 DF, p-value: 0.002138

```

No message vs Improves health

```

Joint_Test9 = data_plus[ which(data_plus$No_message == 1 | data_plus$Improves_Health == 1),]

lm_JT9 = lm(Improves_Health ~ WOOD+TSF_PRIMARY+BUYWOOD_DUMMY+GATHERWOOD_DUMMY , data=Joint_Test9)
summary(lm_JT9)

##
## Call:
## lm(formula = Improves_Health ~ WOOD + TSF_PRIMARY + BUYWOOD_DUMMY +
##      GATHERWOOD_DUMMY, data = Joint_Test9)
##
## Residuals:
##    Min      1Q  Median      3Q     Max
## -0.5869 -0.5144 -0.2422  0.4644  0.7578
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.24217   0.12205   1.984  0.04748 *
## WOOD        0.24985   0.12734   1.962  0.05001 .
## TSF_PRIMARY 0.09493   0.03442   2.758  0.00591 **
## BUYWOOD_DUMMY -0.07252   0.03772  -1.922  0.05480 .
## GATHERWOOD_DUMMY -0.05134   0.05246  -0.979  0.32800
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4975 on 1120 degrees of freedom
## Multiple R-squared:  0.01439,   Adjusted R-squared:  0.01087
## F-statistic: 4.089 on 4 and 1120 DF,  p-value: 0.002697

```

## 2.5 Demand Curves

This is drawn by excel. See the excel file.

## 3. Correlations - Figure 2 and 3

### 3.1 Within Socio-Economic Variables

```

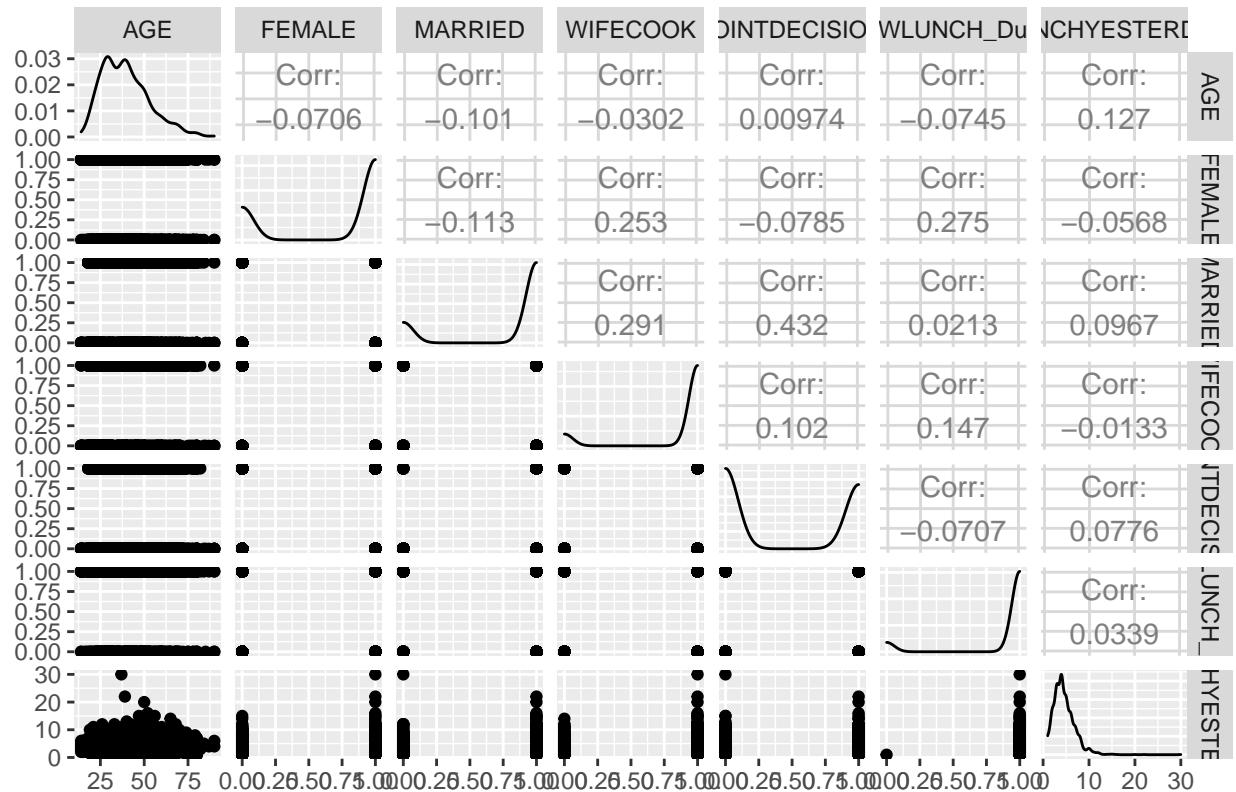
library(GGally)
library(ggplot2)

### Plot the correlations

ggp1=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 4)), columns=c(which(colnames(data_...
print(ggp1 + ggtitle("Scatterplot, Correlation and Histogram of Socio-Econ Variables"))

```

## Scatterplot, Correlation and Histogram of Socio–Econ Variables



All the correlations within socio-economic variables is so low that we do not need to worry about collinearity issues when put them in the regression model.

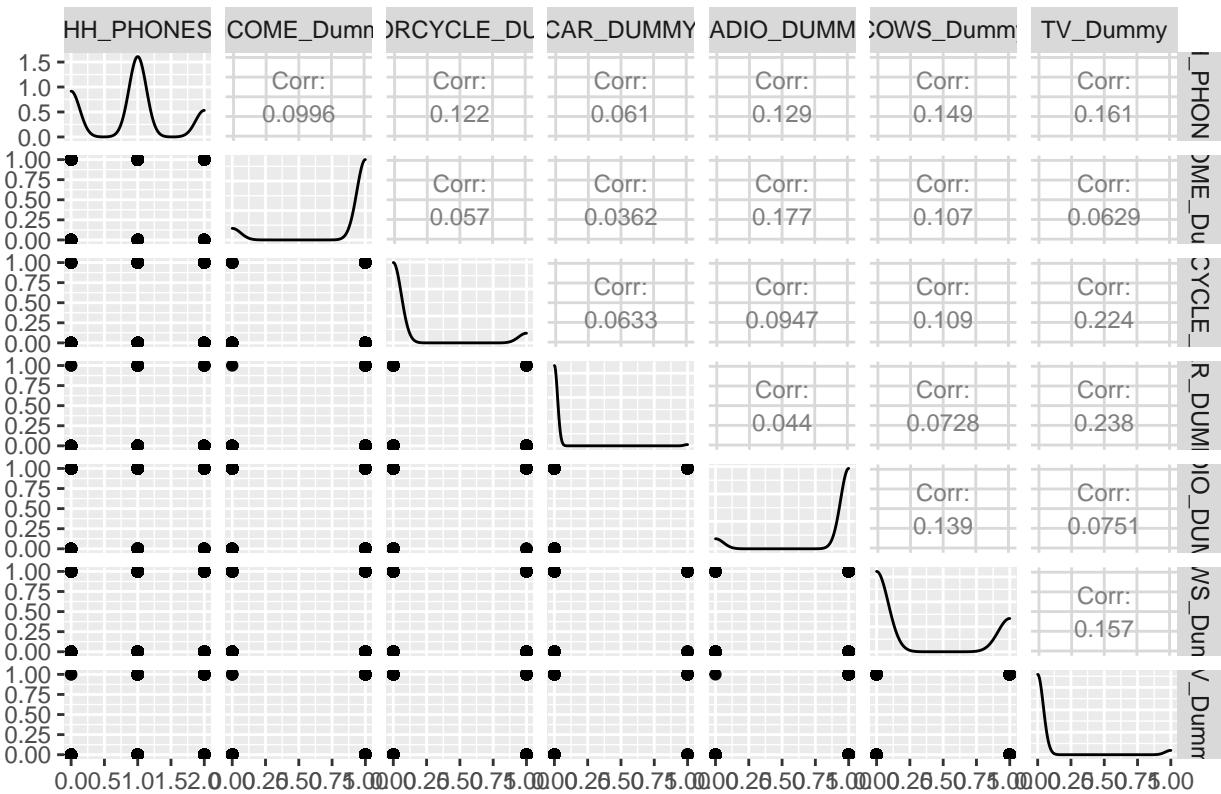
### 3.2 Within Wealth Variables

```
### Clean the data format

data_plus$COWS_Dummy = as.numeric(data_plus$COWS_Dummy)
data_plus$TV_Dummy = as.numeric(data_plus$TV_Dummy)
data_plus$INCOME_Dummy = data_plus$INCOME
data_plus$INCOME_Dummy[data_plus$INCOME_Dummy == "No"] <- 0
data_plus$INCOME_Dummy[data_plus$INCOME_Dummy == "Yes"] <- 1
data_plus$INCOME_Dummy = as.numeric(data_plus$INCOME_Dummy)

### Plot Correlations
ggp2=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 3)), columns=c(which(colnames(data_+))))
```

## Scatterplot, Correlation and Histogram of Wealth Variables

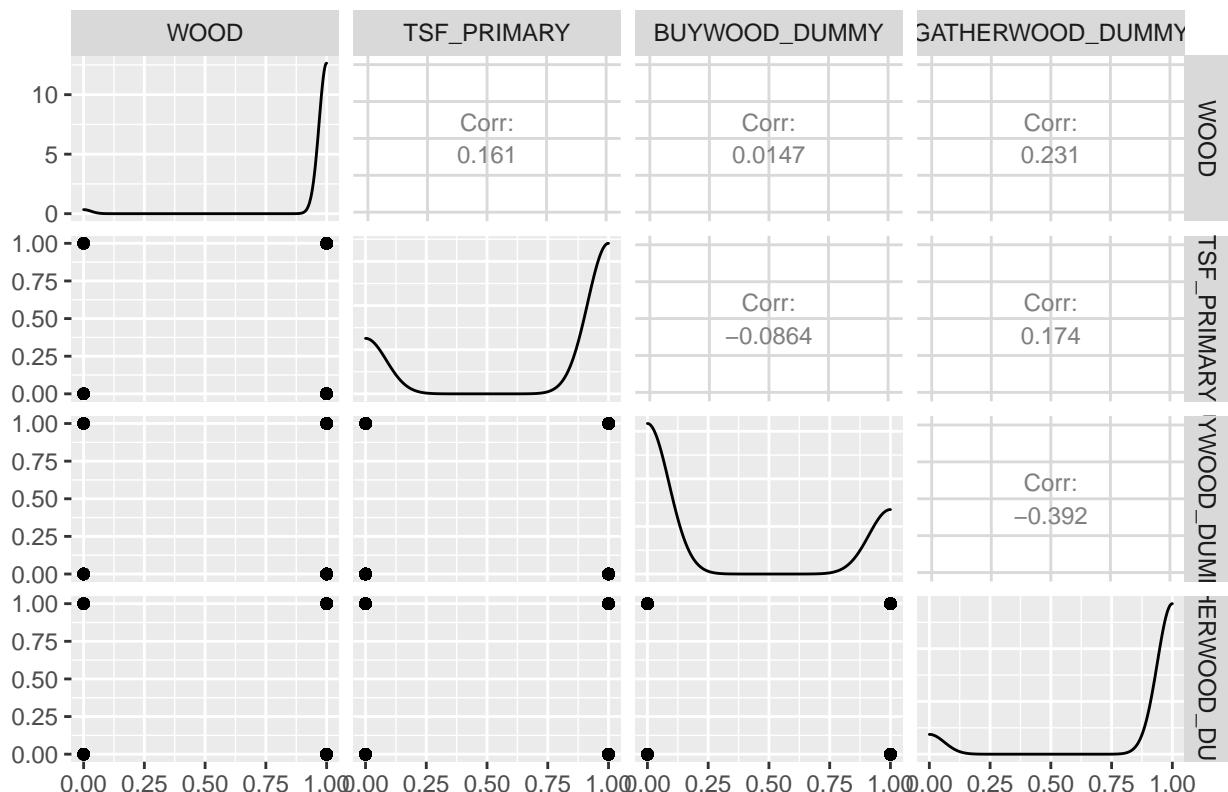


All the correlations within Wealth variables is so low that we do not need to worry about collinearity issues when put them in the regression model.

### 3.3 Within Cookstove use Variables

```
gpp3=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 3)), columns=c(which(colnames(data_1))
print(gpp3 + ggtitle("Scatterplot, Correlation and Histogram of Cookstove Variables"))
```

## Scatterplot, Correlation and Histogram of Cookstove Variables

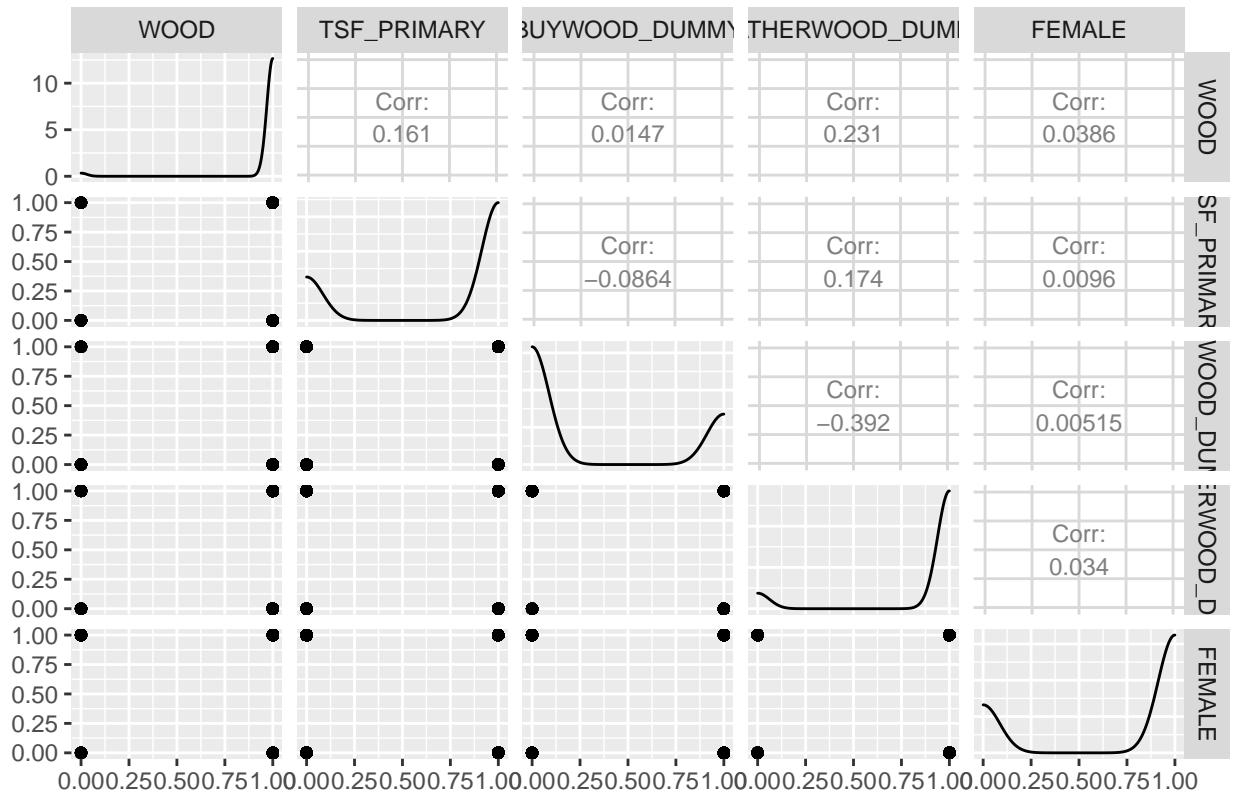


### 3.4 Cross sectional Check - Gender Effect

We check the correlation between female and all cookstove variables

```
ggp4=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 3)), columns=c(which(colnames(data_...)))
print(ggp4 + ggttitle("Scatterplot, Correlation and Histogram of FEMALE & Cookstove"))
```

## Scatterplot, Correlation and Histogram of FEMALE & Cookstove



We can exclude the collinearity issue between gender and cookstove use.

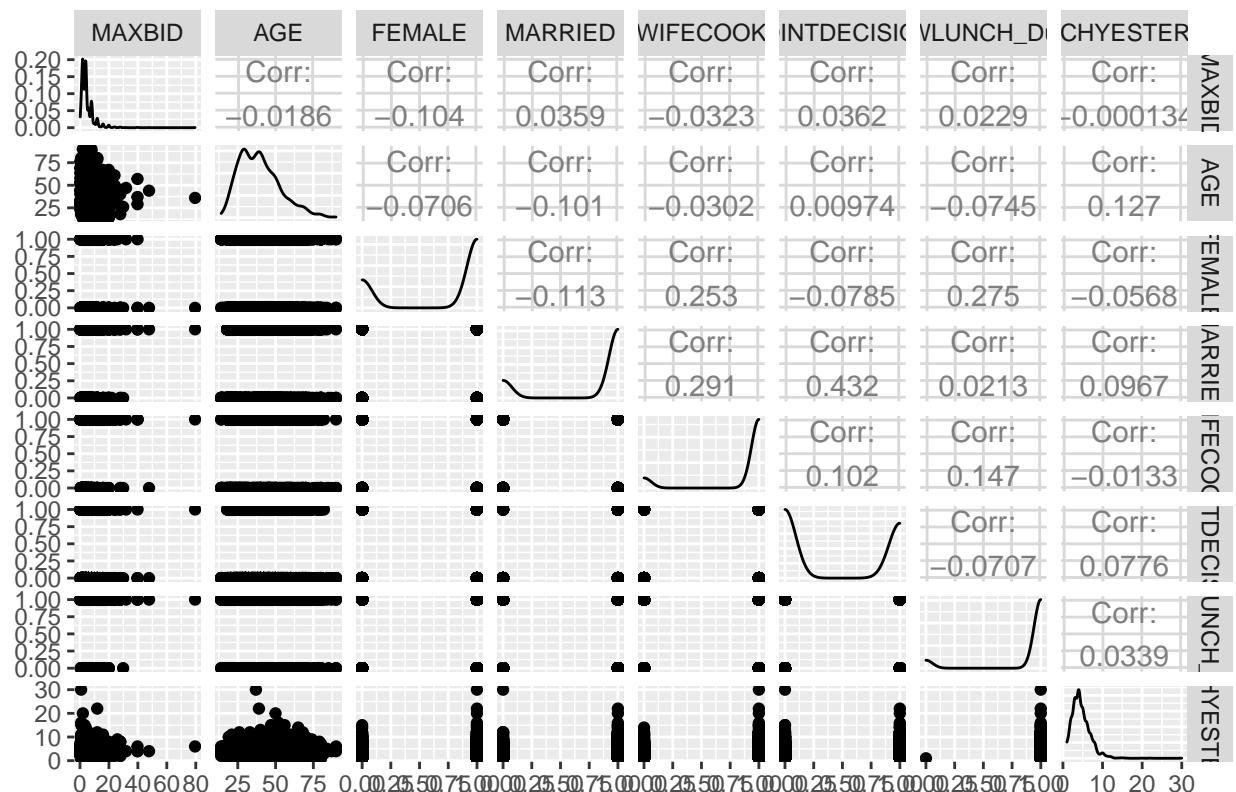
## 4 Dependent on Explanatory Variables - Simple Linear Regressions - Figure 2 and 3

### 4.1 Correlation between Bidprices and the Explanatory Variables

#### 4.1.1 Bidprices with Socio-econ Demographic Variables

```
### Bidprice with Socio-Econ Variables
ggp5=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 4)), columns=c(which(colnames(data_1))
print(ggp5 + ggtitle("Scatterplot, Correlation and Histogram of Bidprices & Socio-Econ Variables"))
```

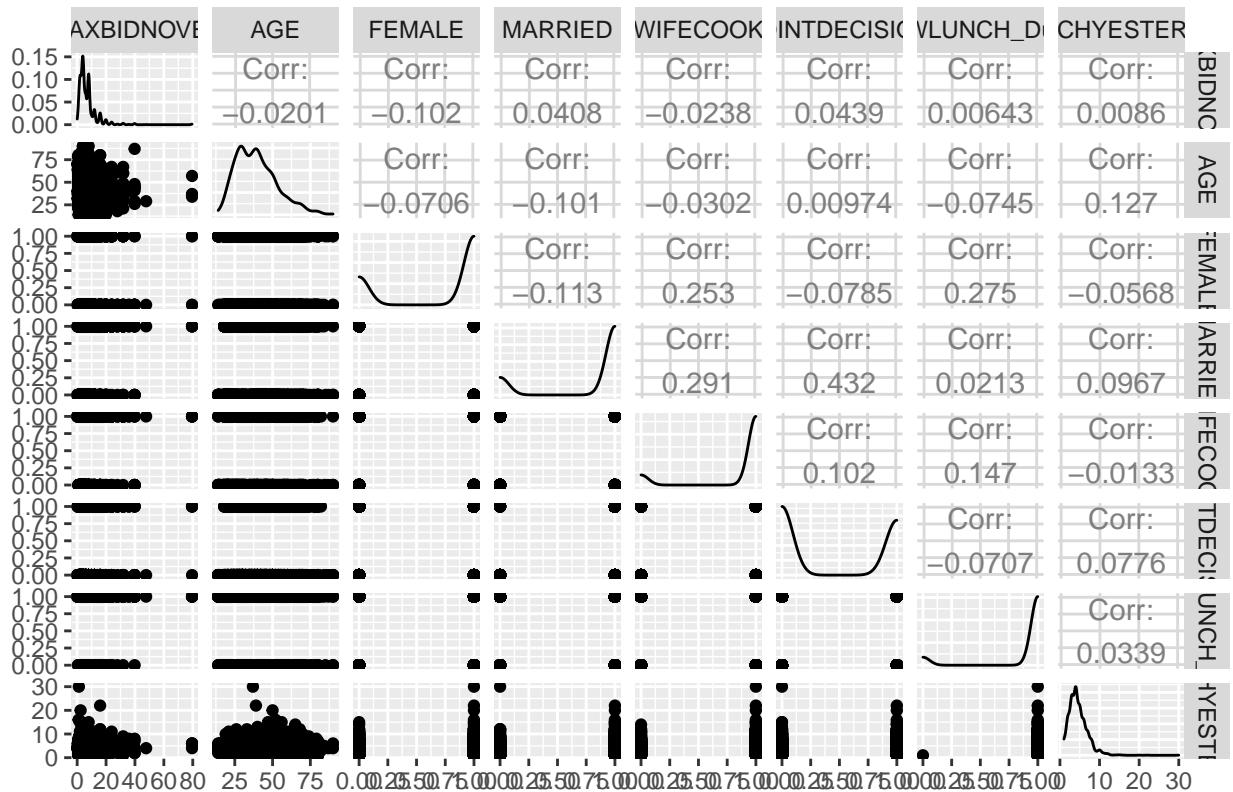
## Scatterplot, Correlation and Histogram of Bidprices & Socio-Econ Variables



```
### Novel bidprice with Socio-Econ Variables
```

```
ggp6=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 4)), columns=c(which(colnames(data_1)
```

## Scatterplot, Correlation and Histogram of Novel Bidprices & Socio-Econ Vari

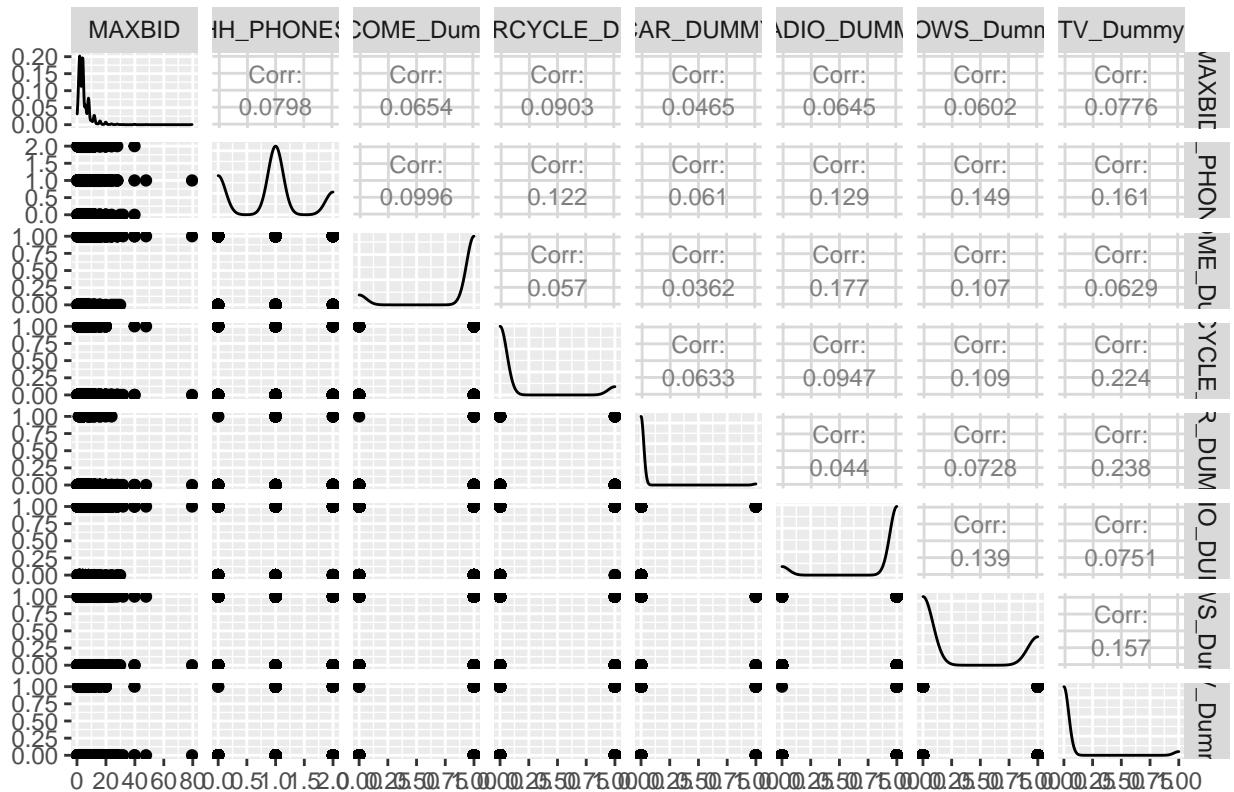


It shows that LUNCHYESTERDAY has ignorable correlation with either bidprices or novel bidprices. AGE, WIFEWOOK,MARRIED, JOINTDECISION and KNOWLUNCH\_Dummy also have very week correlations with bidprices, respectively.

### 4.1.2 Bidprices with Wealth Variables

```
### Bidprice with Wealth
gpp7=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 3)), columns=c(which(colnames(data_),
print(gpp7 + ggttitle("Scatterplot, Correlation and Histogram of Bidprices & Wealth Variables"))
```

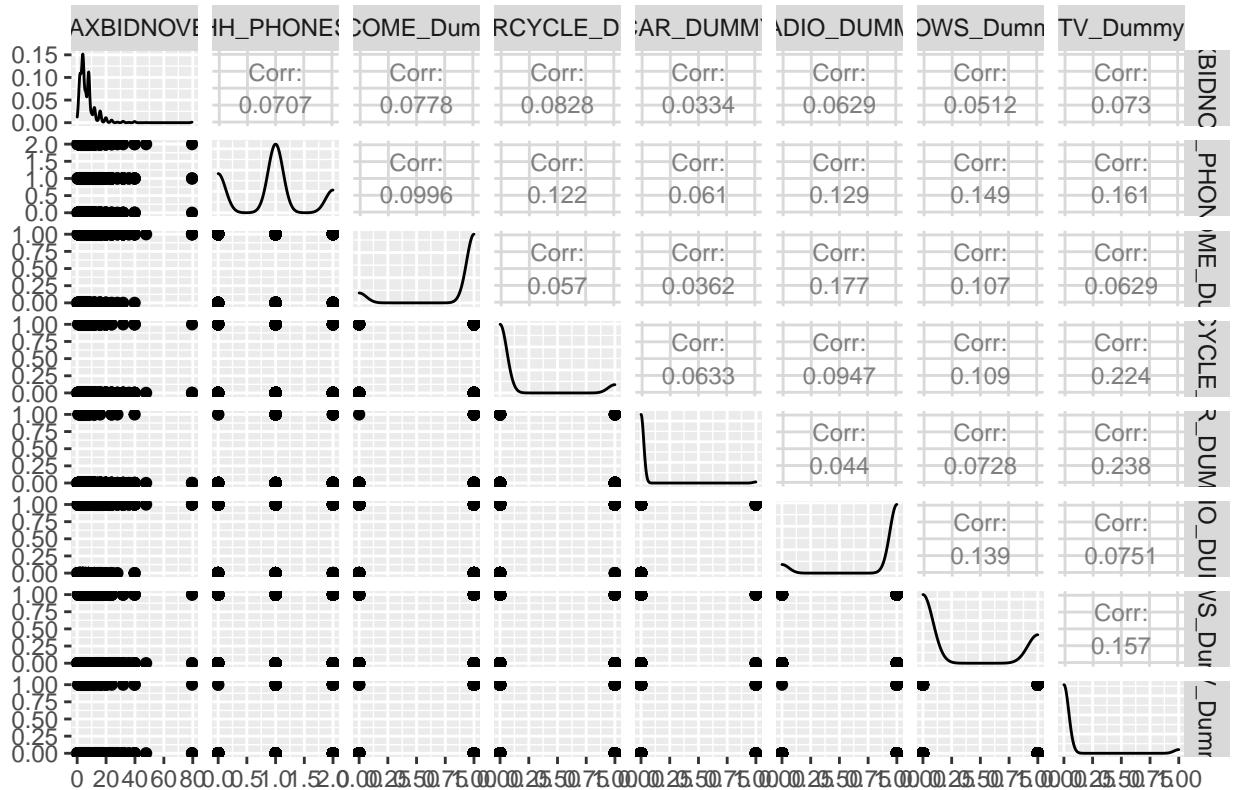
## Scatterplot, Correlation and Histogram of Bidprices & Wealth Variables



### Novel bidprice with Wealth

```
ggp8=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 3)), columns=c(which(colnames(data_1)[1:9]), which(colnames(data_1)[1:9])), print(ggp8 + ggtitle("Scatterplot, Correlation and Histogram of Novel Bidprices & Wealth Variables")))
```

## Scatterplot, Correlation and Histogram of Novel Bidprices & Wealth Variables

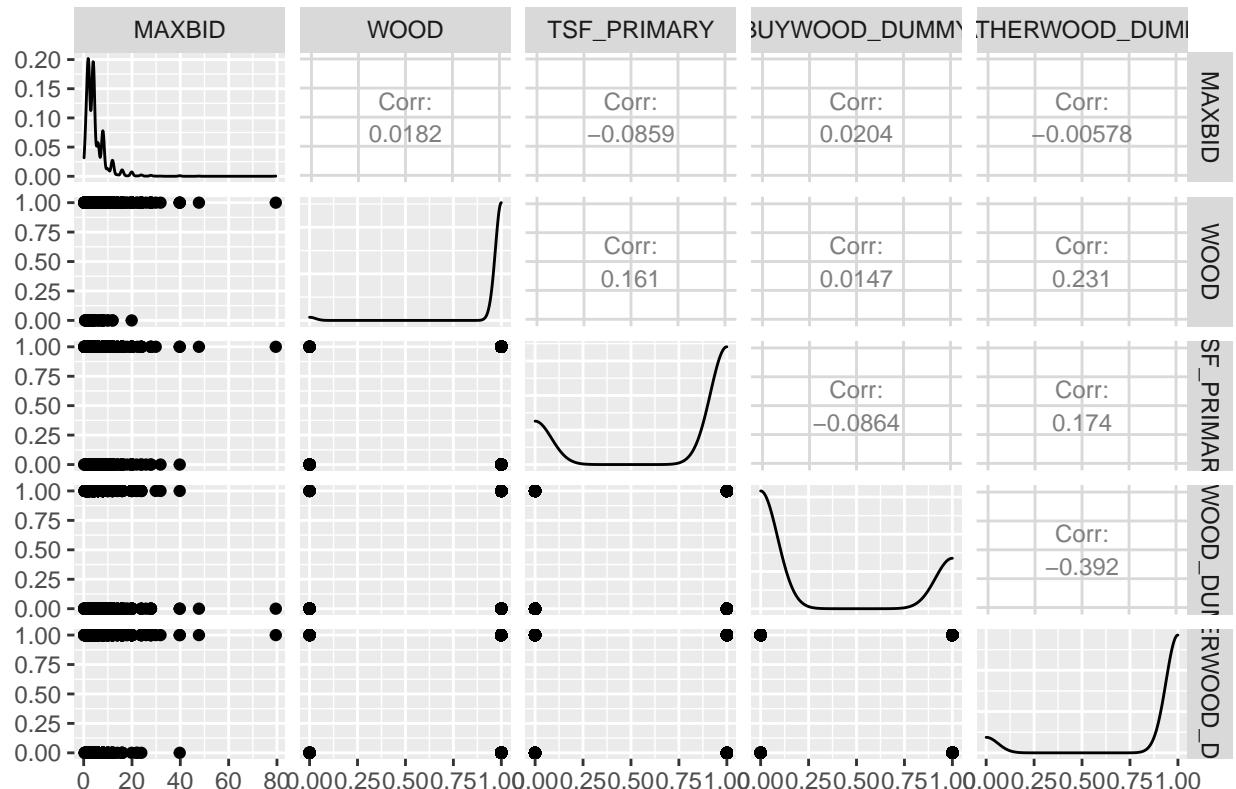


It shows that all the wealth variables have small correlation with either bidprices or novel bidprices, but more consistently, larger than the correlation between socio-economic variables

### 4.1.3 Bidprices with Cookstove Variables

```
### Bidprice with Cookstove
ggp9=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 3)), columns=c(which(colnames(data_...)))
print(ggp9 + ggttitle("Scatterplot, Correlation and Histogram of Bidprices & Cookstove Variables"))
```

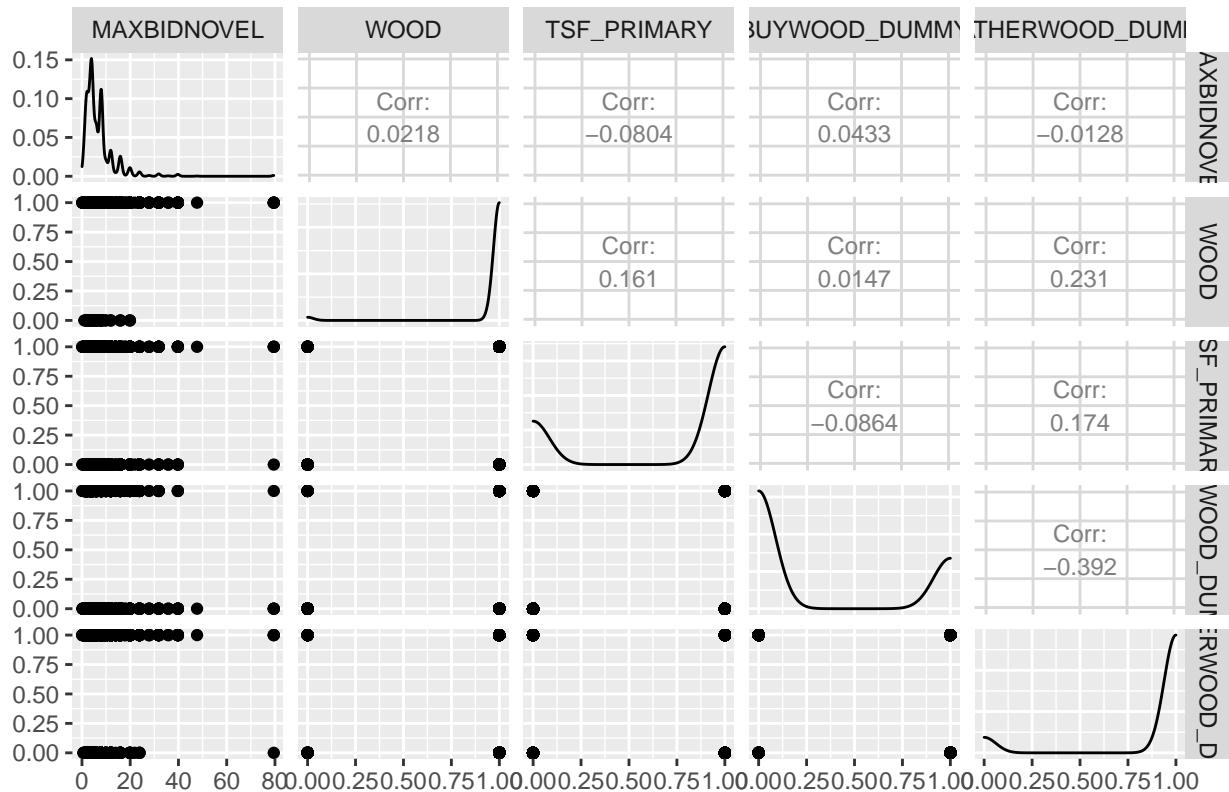
## Scatterplot, Correlation and Histogram of Bidprices & Cookstove Variables



```
### Novel bidprice with Cookstove
```

```
gpp10=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 3)), columns=c(which(colnames(data_plus)[c(1,2,3,4,5)]), which(colnames(data_plus)[c(1,2,3,4,5)])))
```

## Scatterplot, Correlation and Histogram of Novel Bidprices & Cookstove Variables



### 4.1.4 Gender Interaction Term First, create the interactions

```

### Gender with Socio-Economic Variables
data_plus$Female_AGE=data_plus$AGE*data_plus$FEMALE
data_plus$Female_MARRIED=data_plus$MARRIED*data_plus$FEMALE
data_plus$Female_WIFECOOK=data_plus$WIFECOOK*data_plus$FEMALE
data_plus$Female_JOINTDECISION=data_plus$JOINTDECISION*data_plus$FEMALE
data_plus$Female_KNOLUNCH_Dummy=data_plus$KNOLUNCH_Dummy*data_plus$FEMALE
data_plus$Female_LUNCHYESTERDAY=data_plus$LUNCHYESTERDAY*data_plus$FEMALE

### Gender with Wealth
data_plus$Female_HH_PHONES=data_plus$HH_PHONES*data_plus$FEMALE
data_plus$Female_INCOME_Dummy=data_plus$INCOME_Dummy*data_plus$FEMALE
data_plus$Female_MOTORCYCLE_DUMMY=data_plus$MOTORCYCLE_DUMMY*data_plus$FEMALE
data_plus$Female_CAR_DUMMY=data_plus$CAR_DUMMY*data_plus$FEMALE
data_plus$Female_RADIO_DUMMY=data_plus$RADIO_DUMMY*data_plus$FEMALE
data_plus$Female_COWS_Dummy=data_plus$COWS_Dummy*data_plus$FEMALE
data_plus$Female_TV_Dummy=data_plus$TV_Dummy*data_plus$FEMALE

### Gender with Cookstove
data_plus$Female_WOOD=data_plus$WOOD*data_plus$FEMALE
data_plus$Female_TSF_PRIMARY=data_plus$TSF_PRIMARY*data_plus$FEMALE
data_plus$Female_BUYWOOD_DUMMY=data_plus$BUYWOOD_DUMMY*data_plus$FEMALE
data_plus$Female_GATHERWOOD_DUMMY=data_plus$GATHERWOOD_DUMMY*data_plus$FEMALE
data_plus$Female_TotalAsset = data_plus$ASSET_TOTAL*data_plus$FEMALE

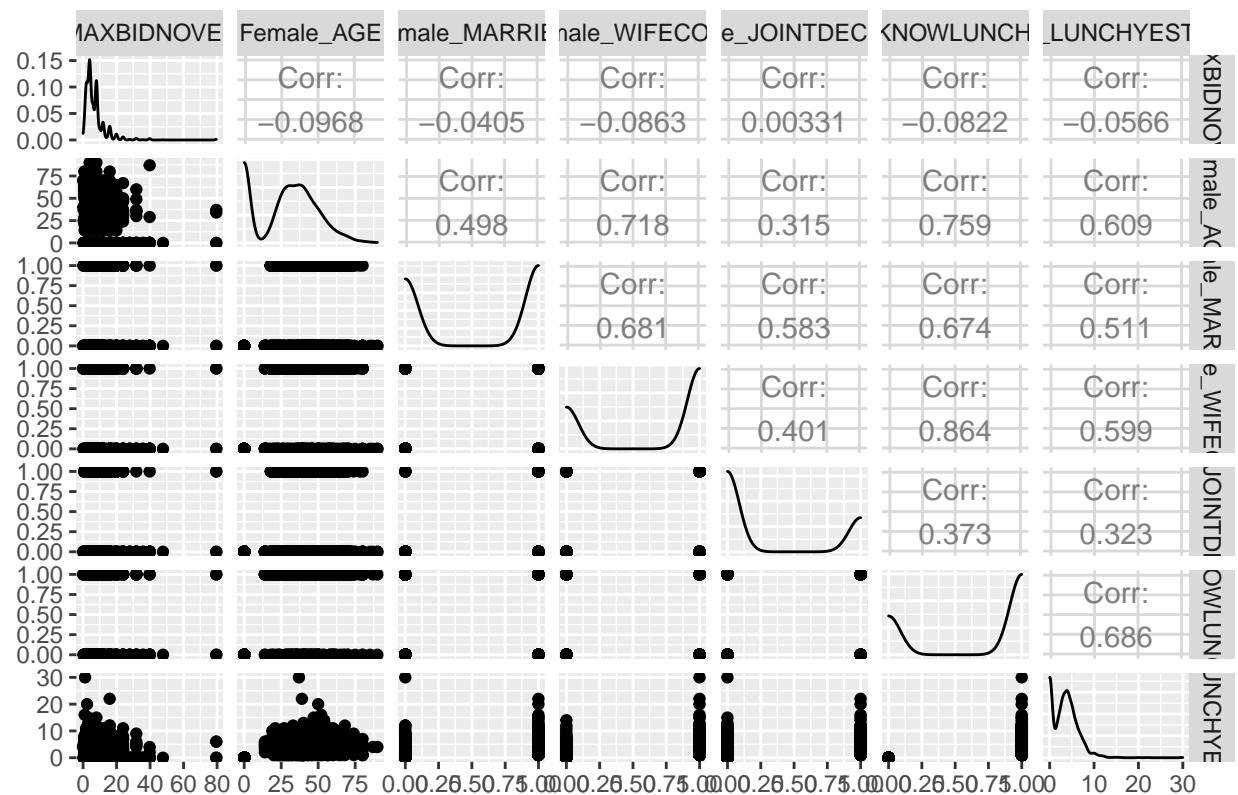
```

Second, check the correlations ##### 1) Bidprices with Gender \* Socio-econ Demographic Variables

```
### Bidprice with Gender*Socio-Econ Variables
```

```
ggp11=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 4)), columns=c(which(colnames(data_plus)[c(1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31,33,35,37,39,41,43,45,47,49,51,53,55,57,59,61,63,65,67,69,71,73,75,77,79,81,83,85,87,89,91,93,95,97,99,101,103,105,107,109,111,113,115,117,119,121,123,125,127,129,131,133,135,137,139,141,143,145,147,149,151,153,155,157,159,161,163,165,167,169,171,173,175,177,179,181,183,185,187,189,191,193,195,197,199,201,203,205,207,209,211,213,215,217,219,221,223,225,227,229,231,233,235,237,239,241,243,245,247,249,251,253,255,257,259,261,263,265,267,269,271,273,275,277,279,281,283,285,287,289,291,293,295,297,299,301,303,305,307,309,311,313,315,317,319,321,323,325,327,329,331,333,335,337,339,341,343,345,347,349,351,353,355,357,359,361,363,365,367,369,371,373,375,377,379,381,383,385,387,389,391,393,395,397,399,401,403,405,407,409,411,413,415,417,419,421,423,425,427,429,431,433,435,437,439,441,443,445,447,449,451,453,455,457,459,461,463,465,467,469,471,473,475,477,479,481,483,485,487,489,491,493,495,497,499,501,503,505,507,509,511,513,515,517,519,521,523,525,527,529,531,533,535,537,539,541,543,545,547,549,551,553,555,557,559,561,563,565,567,569,571,573,575,577,579,581,583,585,587,589,591,593,595,597,599,601,603,605,607,609,611,613,615,617,619,621,623,625,627,629,631,633,635,637,639,641,643,645,647,649,651,653,655,657,659,661,663,665,667,669,671,673,675,677,679,681,683,685,687,689,691,693,695,697,699,701,703,705,707,709,711,713,715,717,719,721,723,725,727,729,731,733,735,737,739,741,743,745,747,749,751,753,755,757,759,761,763,765,767,769,771,773,775,777,779,781,783,785,787,789,791,793,795,797,799,801,803,805,807,809,811,813,815,817,819,821,823,825,827,829,831,833,835,837,839,841,843,845,847,849,851,853,855,857,859,861,863,865,867,869,871,873,875,877,879,881,883,885,887,889,891,893,895,897,899,901,903,905,907,909,911,913,915,917,919,921,923,925,927,929,931,933,935,937,939,941,943,945,947,949,951,953,955,957,959,961,963,965,967,969,971,973,975,977,979,981,983,985,987,989,991,993,995,997,999,1001,1003,1005,1007,1009,1011,1013,1015,1017,1019,1021,1023,1025,1027,1029,1031,1033,1035,1037,1039,1041,1043,1045,1047,1049,1051,1053,1055,1057,1059,1061,1063,1065,1067,1069,1071,1073,1075,1077,1079,1081,1083,1085,1087,1089,1091,1093,1095,1097,1099,1101,1103,1105,1107,1109,1111,1113,1115,1117,1119,1121,1123,1125,1127,1129,1131,1133,1135,1137,1139,1141,1143,1145,1147,1149,1151,1153,1155,1157,1159,1161,1163,1165,1167,1169,1171,1173,1175,1177,1179,1181,1183,1185,1187,1189,1191,1193,1195,1197,1199,1201,1203,1205,1207,1209,1211,1213,1215,1217,1219,1221,1223,1225,1227,1229,1231,1233,1235,1237,1239,1241,1243,1245,1247,1249,1251,1253,1255,1257,1259,1261,1263,1265,1267,1269,1271,1273,1275,1277,1279,1281,1283,1285,1287,1289,1291,1293,1295,1297,1299,1301,1303,1305,1307,1309,1311,1313,1315,1317,1319,1321,1323,1325,1327,1329,1331,1333,1335,1337,1339,1341,1343,1345,1347,1349,1351,1353,1355,1357,1359,1361,1363,1365,1367,1369,1371,1373,1375,1377,1379,1381,1383,1385,1387,1389,1391,1393,1395,1397,1399,1401,1403,1405,1407,1409,1411,1413,1415,1417,1419,1421,1423,1425,1427,1429,1431,1433,1435,1437,1439,1441,1443,1445,1447,1449,1451,1453,1455,1457,1459,1461,1463,1465,1467,1469,1471,1473,1475,1477,1479,1481,1483,1485,1487,1489,1491,1493,1495,1497,1499,1501,1503,1505,1507,1509,1511,1513,1515,1517,1519,1521,1523,1525,1527,1529,1531,1533,1535,1537,1539,1541,1543,1545,1547,1549,1551,1553,1555,1557,1559,1561,1563,1565,1567,1569,1571,1573,1575,1577,1579,1581,1583,1585,1587,1589,1591,1593,1595,1597,1599,1601,1603,1605,1607,1609,1611,1613,1615,1617,1619,1621,1623,1625,1627,1629,1631,1633,1635,1637,1639,1641,1643,1645,1647,1649,1651,1653,1655,1657,1659,1661,1663,1665,1667,1669,1671,1673,1675,1677,1679,1681,1683,1685,1687,1689,1691,1693,1695,1697,1699,1701,1703,1705,1707,1709,1711,1713,1715,1717,1719,1721,1723,1725,1727,1729,1731,1733,1735,1737,1739,1741,1743,1745,1747,1749,1751,1753,1755,1757,1759,1761,1763,1765,1767,1769,1771,1773,1775,1777,1779,1781,1783,1785,1787,1789,1791,1793,1795,1797,1799,1801,1803,1805,1807,1809,1811,1813,1815,1817,1819,1821,1823,1825,1827,1829,1831,1833,1835,1837,1839,1841,1843,1845,1847,1849,1851,1853,1855,1857,1859,1861,1863,1865,1867,1869,1871,1873,1875,1877,1879,1881,1883,1885,1887,1889,1891,1893,1895,1897,1899,1901,1903,1905,1907,1909,1911,1913,1915,1917,1919,1921,1923,1925,1927,1929,1931,1933,1935,1937,1939,1941,1943,1945,1947,1949,1951,1953,1955,1957,1959,1961,1963,1965,1967,1969,1971,1973,1975,1977,1979,1981,1983,1985,1987,1989,1991,1993,1995,1997,1999,2001,2003,2005,2007,2009,2011,2013,2015,2017,2019,2021,2023,2025,2027,2029,2031,2033,2035,2037,2039,2041,2043,2045,2047,2049,2051,2053,2055,2057,2059,2061,2063,2065,2067,2069,2071,2073,2075,2077,2079,2081,2083,2085,2087,2089,2091,2093,2095,2097,2099,2101,2103,2105,2107,2109,2111,2113,2115,2117,2119,2121,2123,2125,2127,2129,2131,2133,2135,2137,2139,2141,2143,2145,2147,2149,2151,2153,2155,2157,2159,2161,2163,2165,2167,2169,2171,2173,2175,2177,2179,2181,2183,2185,2187,2189,2191,2193,2195,2197,2199,2201,2203,2205,2207,2209,2211,2213,2215,2217,2219,2221,2223,2225,2227,2229,2231,2233,2235,2237,2239,2241,2243,2245,2247,2249,2251,2253,2255,2257,2259,2261,2263,2265,2267,2269,2271,2273,2275,2277,2279,2281,2283,2285,2287,2289,2291,2293,2295,2297,2299,2301,2303,2305,2307,2309,2311,2313,2315,2317,2319,2321,2323,2325,2327,2329,2331,2333,2335,2337,2339,2341,2343,2345,2347,2349,2351,2353,2355,2357,2359,2361,2363,2365,2367,2369,2371,2373,2375,2377,2379,2381,2383,2385,2387,2389,2391,2393,2395,2397,2399,2401,2403,2405,2407,2409,2411,2413,2415,2417,2419,2421,2423,2425,2427,2429,2431,2433,2435,2437,2439,2441,2443,2445,2447,2449,2451,2453,2455,2457,2459,2461,2463,2465,2467,2469,2471,2473,2475,2477,2479,2481,2483,2485,2487,2489,2491,2493,2495,2497,2499,2501,2503,2505,2507,2509,2511,2513,2515,2517,2519,2521,2523,2525,2527,2529,2531,2533,2535,2537,2539,2541,2543,2545,2547,2549,2551,2553,2555,2557,2559,2561,2563,2565,2567,2569,2571,2573,2575,2577,2579,2581,2583,2585,2587,2589,2591,2593,2595,2597,2599,2601,2603,2605,2607,2609,2611,2613,2615,2617,2619,2621,2623,2625,2627,2629,2631,2633,2635,2637,2639,2641,2643,2645,2647,2649,2651,2653,2655,2657,2659,2661,2663,2665,2667,2669,2671,2673,2675,2677,2679,2681,2683,2685,2687,2689,2691,2693,2695,2697,2699,2701,2703,2705,2707,2709,2711,2713,2715,2717,2719,2721,2723,2725,2727,2729,2731,2733,2735,2737,2739,2741,2743,2745,2747,2749,2751,2753,2755,2757,2759,2761,2763,2765,2767,2769,2771,2773,2775,2777,2779,2781,2783,2785,2787,2789,2791,2793,2795,2797,2799,2801,2803,2805,2807,2809,2811,2813,2815,2817,2819,2821,2823,2825,2827,2829,2831,2833,2835,2837,2839,2841,2843,2845,2847,2849,2851,2853,2855,2857,2859,2861,2863,2865,2867,2869,2871,2873,2875,2877,2879,2881,2883,2885,2887,2889,2891,2893,2895,2897,2899,2901,2903,2905,2907,2909,2911,2913,2915,2917,2919,2921,2923,2925,2927,2929,2931,2933,2935,2937,2939,2941,2943,2945,2947,2949,2951,2953,2955,2957,2959,2961,2963,2965,2967,2969,2971,2973,2975,2977,2979,2981,2983,2985,2987,2989,2991,2993,2995,2997,2999,3001,3003,3005,3007,3009,3011,3013,3015,3017,3019,3021,3023,3025,3027,3029,3031,3033,3035,3037,3039,3041,3043,3045,3047,3049,3051,3053,3055,3057,3059,3061,3063,3065,3067,3069,3071,3073,3075,3077,3079,3081,3083,3085,3087,3089,3091,3093,3095,3097,3099,3101,3103,3105,3107,3109,3111,3113,3115,3117,3119,3121,3123,3125,3127,3129,3131,3133,3135,3137,3139,3141,3143,3145,3147,3149,3151,3153,3155,3157,3159,3161,3163,3165,3167,3169,3171,3173,3175,3177,3179,3181,3183,3185,3187,3189,3191,3193,3195,3197,3199,3201,3203,3205,3207,3209,3211,3213,3215,3217,3219,3221,3223,3225,3227,3229,3231,3233,3235,3237,3239,3241,3243,3245,3247,3249,3251,3253,3255,3257,3259,3261,3263,3265,3267,3269,3271,3273,3275,3277,3279,3281,3283,3285,3287,3289,3291,3293,3295,3297,3299,3301,3303,3305,3307,3309,3311,3313,3315,3317,3319,3321,3323,3325,3327,3329,3331,3333,3335,3337,3339,3341,3343,3345,3347,3349,3351,3353,3355,3357,3359,3361,3363,3365,3367,3369,3371,3373,3375,3377,3379,3381,3383,3385,3387,3389,3391,3393,3395,3397,3399,3401,3403,3405,3407,3409,3411,3413,3415,3417,3419,3421,3423,3425,3427,3429,3431,3433,3435,3437,3439,3441,3443,3445,3447,3449,3451,3453,3455,3457,3459,3461,3463,3465,3467,3469,3471,3473,3475,3477,3479,3481,3483,3485,3487,3489,3491,3493,3495,3497,3499,3501,3503,3505,3507,3509,3511,3513,3515,3517,3519,3521,3523,3525,3527,3529,3531,3533,3535,3537,3539,3541,3543,3545,3547,3549,3551,3553,3555,3557,3559,3561,3563,3565,3567,3569,3571,3573,3575,3577,3579,3581,3583,3585,3587,3589,3591,3593,3595,3597,3599,3601,3603,3605,3607,3609,3611,3613,3615,3617,3619,3621,3623,3625,3627,3629,3631,3633,3635,3637,3639,3641,3643,3645,3647,3649,3651,3653,3655,3657,3659,3661,3663,3665,3667,3669,3671,3673,3675,3677,3679,3681,3683,3685,3687,3689,3691,3693,3695,3697,3699,3701,3703,3705,3707,3709,3711,3713,3715,3717,3719,3721,3723,3725,3727,3729,3731,3733,3735,3737,3739,3741,3743,3745,3747,3749,3751,3753,3755,3757,3759,3761,3763,3765,3767,3769,3771,3773,3775,3777,3779,3781,3783,3785,3787,3789,3791,3793,3795,3797,3799,3801,3803,3805,3807,3809,3811,3813,3815,3817,3819,3821,3823,3825,3827,3829,3831,3833,3835,3837,3839,3841,3843,3845,3847,3849,3851,3853,3855,3857,3859,3861,3863,3865,3867,3869,3871,3873,3875,3877,3879,3881,3883,3885,3887,3889,3891,3893,3895,3897,3899,3901,3903,3905,3907,3909,3911,3913,3915,3917,3919,3921,3923,3925,3927,3929,3931,3933,3935,3937,3939,3941,3943,3945,3947,3949,3951,3953,3955,3957,3959,3961,3963,3965,3967,3969,3971,3973,3975,3977,3979,3981,3983,3985,3987,3989,3991,3993,3995,3997,3999,4001,4003,4005,4007,4009,4011,4013,4015,4017,4019,4021,4023,4025,4027,4029,4031,4033,4035,4037,4039,4041,4043,4045,4047,4049,4051,4053,4055,4057,4059,4061,4063,4065,4067,4069,4071,4073,4075,4077,4079,4081,4083,4085,4087,4089,4091,4093,4095,4097,4099,4101,4103,4105,4107,4109,4111,4113,4115,4117,4119,4121,4123,4125,4127,4129,4131,4133,4135,4137,4139,4141,4143,4145,4147,4149,4151,4153,4155,4157,4159,4161,4163,4165,4167,4169,4171,4173,4175,4177,4179,4181,4183,4185,4187,4189,4191,4193,4195,4197,4199,4201,4203,4205,4207,4209,4211,4213,4215,4217,4219,4221,4223,4225,4227,4229,4231,4233,4235,4237,4239,4241,4243,4245,4247,4249,4251,4253,4255,4257,4259,4261,4263,4265,4267,4269,4271,4273,4275,4277,4279,4281,4283,4285,4287,4289,4291,4293,4295,4297,4299,4301,4303,4305,4307,4309,4311,4313,4315,4317,4319,4321,4323,4325,4327,4329,4331,4333,4335,4337,4339,4341,4343,4345,4347,4349,4351,4353,4355,4357,4359,4361,4363,4365,4367,4369,4371,4373,4375,4377,4379,4381,4383,4385,4387,4389,4391,4393,4395,4397,4399,4401,4403,4405,4407,4409,4411,4413,4415,4417,4419,4421,4423,4425,4427,4429,4431,4433,4435,4437,4439,4441,4443,4445,4447,4449,4451,4453,4455,4457,4459,4461,4463,4465,4467,4469,4471,4473,4475,4477,4479,4481,4483,4485,4487,4489,4491,4493,4495,4497,4499,4501,4503,4505,4507,4509,4511,4513,4515,4517,4519,4521,4523,4525,4527,4529,4531,4533,4535,4537,4539,4541,4543,4545,4547,4549,4551,4553,4555,4557,4559,4561,4563,4565,4567,4569,4571,4573,4575,4577,4579,4581,4583,4585,4587,4589,4591,4593,4595,4597,4599,4601,4603,4605,4607,4609,4611,4613,4615,4617,4619,4621,4623,4625,4627,4629,4631,4633,4635,4637,4639,4641,4643,4645,4647,4649,4651,4653,4655,4657,4659,4661,4663,4665,4667,4669,4671,4673,4675,4677,4679,4681,4683,4685,4687,4689,4691,4693,4695,4697,4699,4701,4703,4705,4707,4709,4711,4713,4715,4717,4719,4721,4723,4725,4727,4729,4731,4733,4735,
```

## Scatterplot, Correlation and Histogram of Novel Bidprices & Gender \* Socio-

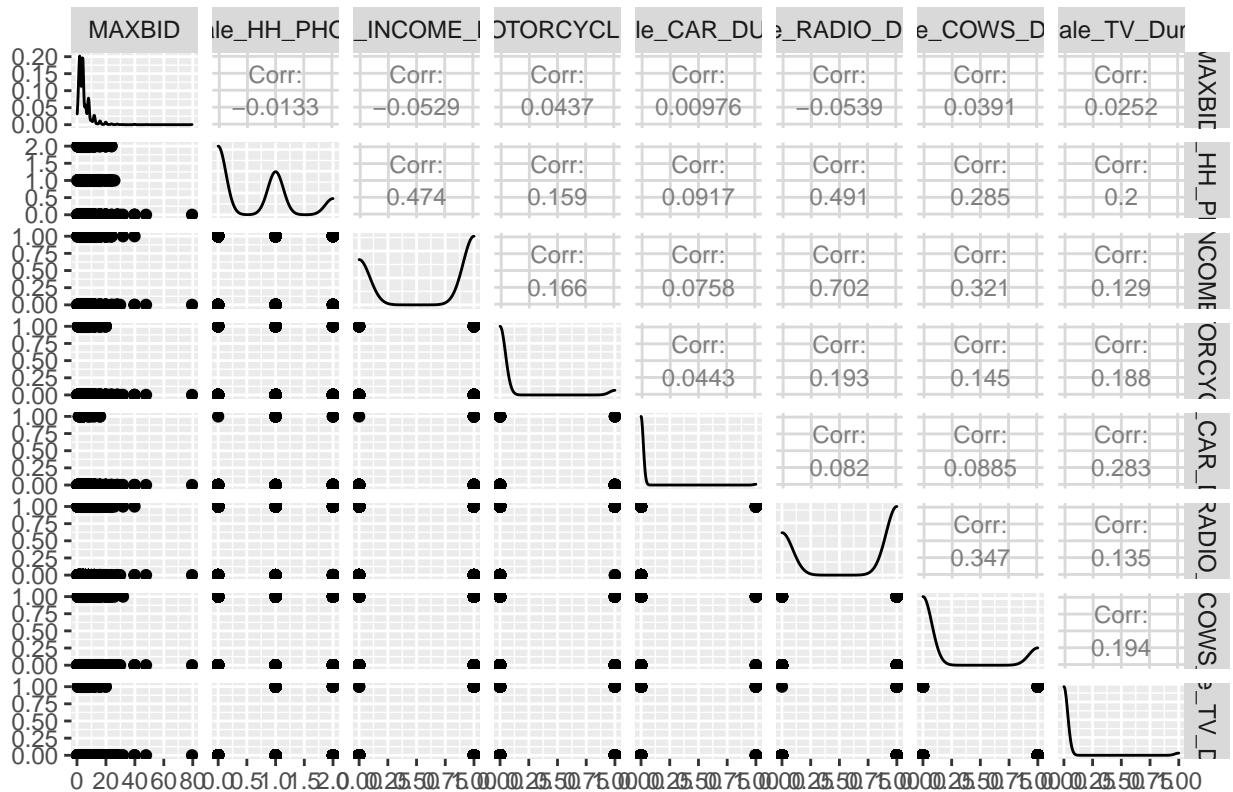


#### 2) Bidprices with Gender \* Wealth Variables

### Bidprice with Gender\*Wealth

```
ggp13=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 3)), columns=c(which(colnames(data_plus)[c(1,3,5,7,9,11,13)]), which(colnames(data_plus)[c(2,4,6,8,10,12,14)])))
print(ggp13 + ggtitle("Scatterplot, Correlation and Histogram of Bidprices & Gender*Wealth Variables"))
```

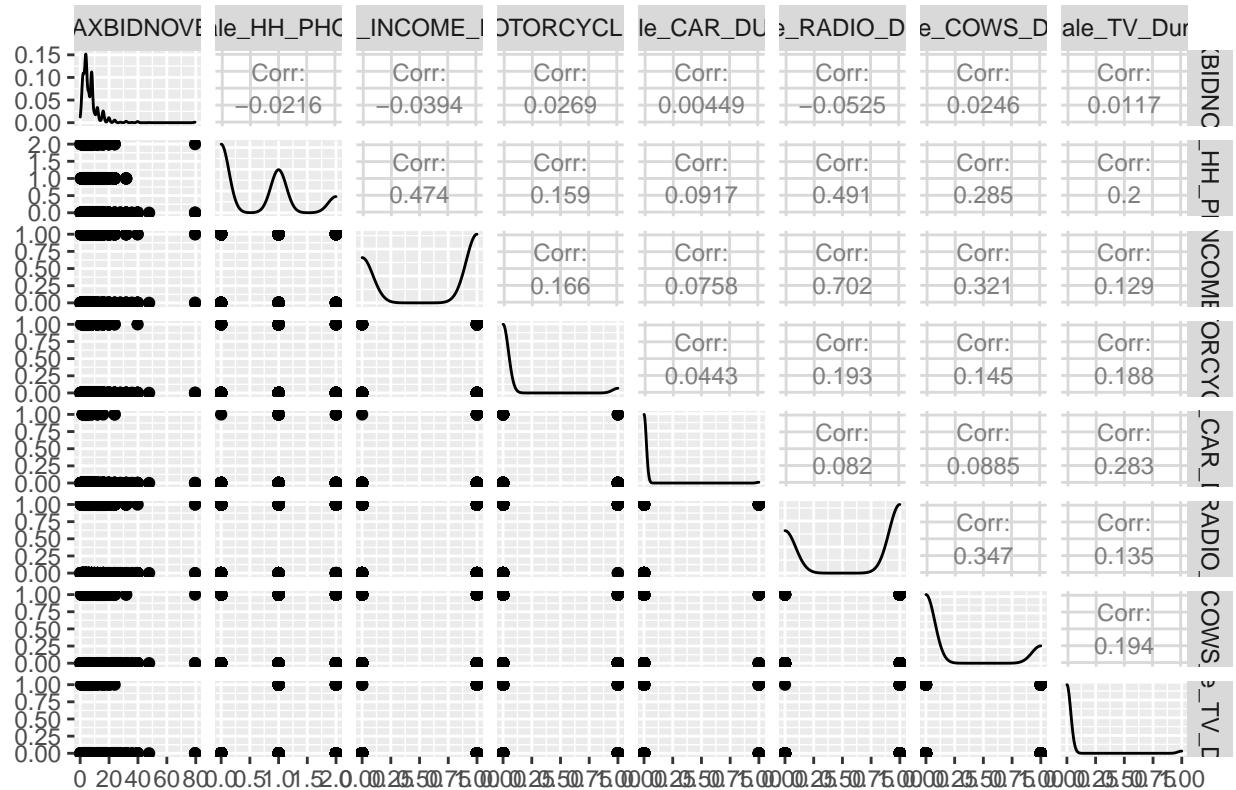
## Scatterplot, Correlation and Histogram of Bidprices & Gender\*Wealth Variables



```
### Novel bidprice with Gender*Wealth
```

```
ggp14=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 3)), columns=c(which(colnames(data_plus)[c(1,2,3,4,5,6,7,8,9)])))
print(ggp14 + ggtitle("Scatterplot, Correlation and Histogram of Novel Bidprices & Gender*Wealth Variables"))
```

## Scatterplot, Correlation and Histogram of Novel Bidprices & Gender\*Wealth Variables

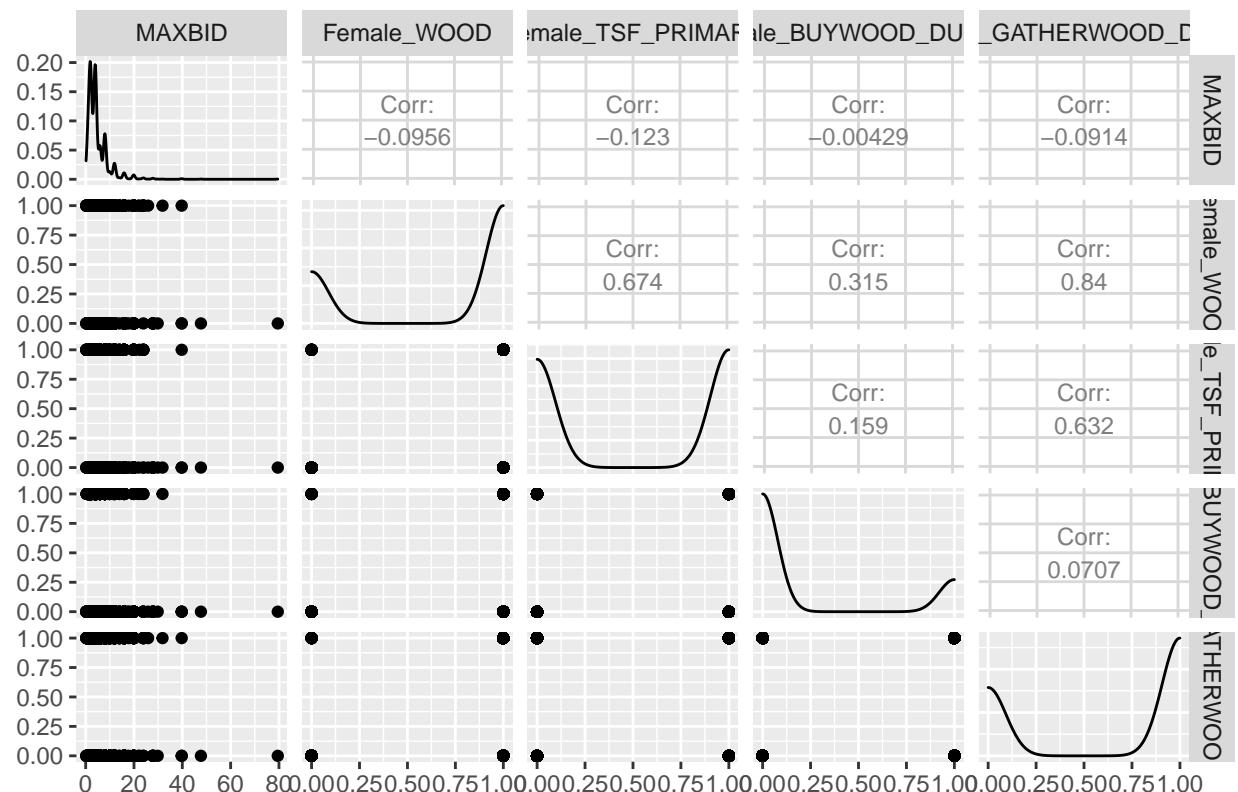


#### 3) Bidprices with Gender \* Cookstove Variables

### Bidprice with Cookstove

```
ggp15=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 3)), columns=c(which(colnames(data_plus)[c(1,2,3,4,5,6,7,8,9)])))
print(ggp15 + ggtitle("Scatterplot, Correlation and Histogram of Bidprices & Gender*Cookstove Variables"))
```

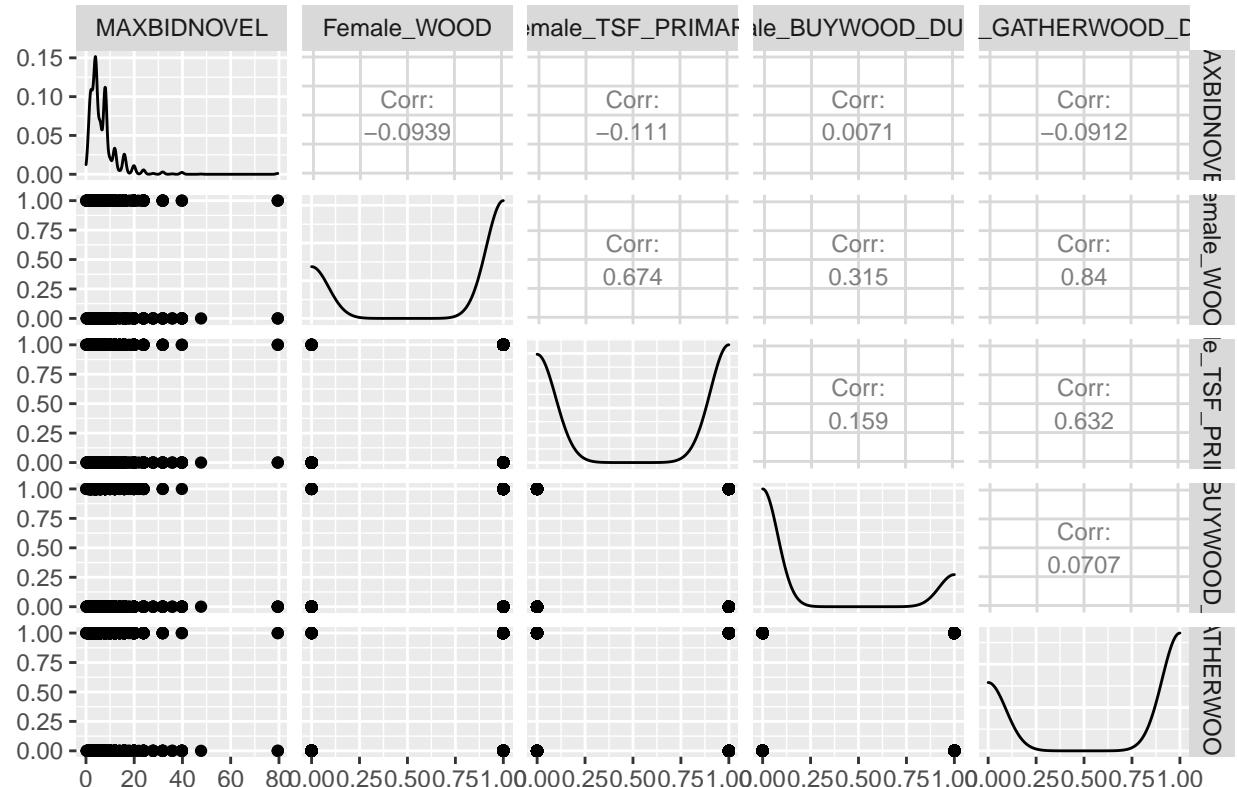
## Scatterplot, Correlation and Histogram of Bidprices & Gender\*Cookstove Var



```
### Novel bidprice with Cookstove
```

```
gpp16=ggpairs(data_plus,upper = list(continuous = wrap("cor", size = 3)), columns=c(which(colnames(data_plus)[c(1,2,3,4,5)])))
print(gpp16 + ggttitle("Scatterplot, Correlation and Histogram of Novel Bidprices & Gender*Cookstove Variables"))
```

## Scatterplot, Correlation and Histogram of Novel Bidprices & Gender\*Cooksto



### 4.1.5 Important Variables Noted

*Absolute value of correlation - 10% FEMALE, HH\_PHONE, TSF\_PRIMARY, BICYCLE\_Dummy.*

*Absolute value of correlation - 5%*

MARRIED, JOINTDECISION, INCOME\_Dummy, CAR\_Dummy, RADIO\_Dummy, COW\_Dummy, TV\_Dummy.

*Absolute value of correlation - 1%*

AGE, FEMALE, WIFECOOK, KNOWLUNCH\_DUMMY, WOOD, BUYWOOD.

*Absolute value of correlation - <1%*

GATHERWOOD\_DUMMY, LUNCHYESTERDAY, KNOWLUNCH\_Dummy

**Save the augmented data**

After combine the asset variable created, we form a data\_plus file, both in csv and dta.

```
### save the expanding dataset
write.csv(data_plus,"data_plus.csv")
```

```
library(foreign)
write.dta(data_plus, "data_plus.dta")
```

All the correlations within Cookstove variables is so low that we do not need to worry about collinearity issues when put them in the regression model.

## 4.2 Simple linear regressions

The results are the base for section 4, which will be discussed later.

## 5 Bidprices on group and explanatory variables (fixed effect) - table 4,5 and 6

District FE Survey Day FE

### 5.1 Multiple regression without controls [District FE + Survey Date FE]

pay within week vs four weeks.

*Note: NA as a coefficient in a regression indicates that the variable in question is linearly related to the other variables.*

```
### run a pair of models without fixed effects
lm1 = lm(MAXBID ~ Improves_Health+Time_Money+Time_Money_Health, data = data_plus)
summary(lm1)

##
## Call:
## lm(formula = MAXBID ~ Improves_Health + Time_Money + Time_Money_Health,
##      data = data_plus)
##
## Residuals:
##      Min    1Q Median    3Q   Max 
## -5.304 -2.595 -0.903  1.381 74.939 
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)    
## (Intercept) 4.5834    0.1990  23.032 < 2e-16 ***
## Improves_Health 0.9197    0.2840   3.239  0.00122 ** 
## Time_Money   -0.1083    0.2861  -0.379  0.70503    
## Time_Money_Health 0.2956    0.2820   1.049  0.29451    
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.642 on 2115 degrees of freedom
##   (109 observations deleted due to missingness)
## Multiple R-squared:  0.007288,  Adjusted R-squared:  0.00588 
## F-statistic: 5.176 on 3 and 2115 DF,  p-value: 0.001453

lm2 = lm(MAXBIDNOVEL ~ Improves_Health+Time_Money+Time_Money_Health, data = data_plus)
summary(lm2)
```

```
##
## Call:
## lm(formula = MAXBIDNOVEL ~ Improves_Health + Time_Money + Time_Money_Health,
##      data = data_plus)
##
```

```

## Residuals:
##      Min     1Q Median     3Q    Max
## -6.780 -3.557 -1.845  1.215 72.785
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 6.73777   0.27434 24.560 <2e-16 ***
## Improves_Health 0.07768   0.39322  0.198   0.843
## Time_Money     0.42168   0.38980  1.082   0.279
## Time_Money_Health -0.12090  0.38816 -0.311   0.755
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.387 on 2125 degrees of freedom
##   (99 observations deleted due to missingness)
## Multiple R-squared:  0.001003, Adjusted R-squared:  -0.0004073
## F-statistic: 0.7112 on 3 and 2125 DF, p-value: 0.5453

### Run a pair of fixed effect models - pay within week
lm3 = lm(MAXBID ~ Improves_Health+Time_Money+Time_Money_Health+DATESURVEY+PARISH+ASSET_TOTAL- 1, data=data_plus)
summary(lm3)

```

```

##
## Call:
## lm(formula = MAXBID ~ Improves_Health + Time_Money + Time_Money_Health +
##     DATESURVEY + PARISH + ASSET_TOTAL - 1, data = data_plus,
##     na.action = na.omit)
##
## Residuals:
##      Min     1Q Median     3Q    Max
## -9.233 -2.254 -0.782  1.133 75.033
##
## Coefficients: (17 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)
## Improves_Health 9.679e-01  2.627e-01  3.684 0.000236 ***
## Time_Money      8.384e-02  2.651e-01  0.316 0.751877
## Time_Money_Health 3.295e-01  2.608e-01  1.263 0.206652
## DATESURVEY01-Feb-12 4.464e+00  6.175e-01  7.229 6.83e-13 ***
## DATESURVEY01-Mar-12 3.219e+00  5.559e-01  5.791 8.08e-09 ***
## DATESURVEY02-Feb-12 3.401e+00  6.274e-01  5.421 6.62e-08 ***
## DATESURVEY03-Feb-12 5.092e+00  6.228e-01  8.176 5.04e-16 ***
## DATESURVEY06-Feb-12 7.172e+00  6.730e-01 10.657 < 2e-16 ***
## DATESURVEY07-Feb-12 3.690e+00  5.544e-01  6.656 3.59e-11 ***
## DATESURVEY08-Feb-12 8.656e+00  5.944e-01 14.561 < 2e-16 ***
## DATESURVEY09-Feb-12 6.757e+00  7.058e-01  9.573 < 2e-16 ***
## DATESURVEY10-Feb-12 6.801e+00  6.649e-01 10.230 < 2e-16 ***
## DATESURVEY14-Feb-12 3.802e+00  1.249e+00  3.044 0.002362 **
## DATESURVEY15-Feb-12 2.623e+00  5.928e-01  4.424 1.02e-05 ***
## DATESURVEY16-Feb-12 1.801e+00  2.165e+00  0.832 0.405524
## DATESURVEY17-Feb-12 3.584e+00  4.293e+00  0.835 0.403953
## DATESURVEY21-Feb-12 3.071e+00  4.294e+00  0.715 0.474469
## DATESURVEY22-Feb-12 1.953e+00  5.247e-01  3.722 0.000203 ***
## DATESURVEY23-Feb-12 1.961e+00  6.030e-01  3.253 0.001162 **
## DATESURVEY24-Feb-12 3.619e+00  5.929e-01  6.105 1.23e-09 ***

```

```

## DATESURVEY27-Feb-12      1.475e+00  4.294e+00  0.343  0.731269
## DATESURVEY28-Feb-12      4.633e+00  5.358e-01  8.647  < 2e-16 ***
## DATESURVEY29-Feb-12      4.441e+00  5.533e-01  8.027  1.66e-15 ***
## DATESURVEY31-Jan-12      2.415e+00  5.763e-01  4.191  2.90e-05 ***
## PARISHBukiro              4.968e+00  2.228e+00  2.229  0.025895 *
## PARISHBwengure             2.816e+00  4.320e+00  0.652  0.514487
## PARISHKabarama             3.911e+00  7.829e-01  4.995  6.38e-07 ***
## PARISHKakigaani            -3.440e+00 9.080e-01 -3.789  0.000156 ***
## PARISHKamomo               -2.153e+00 7.946e-01 -2.710  0.006783 **
## PARISHKibingo_Bugamba      NA          NA          NA          NA
## PARISHKibingo_Kagogi       NA          NA          NA          NA
## PARISHKigaaga              2.076e+00  8.024e-01  2.587  0.009736 **
## PARISHKitunguru            NA          NA          NA          NA
## PARISHKongoro               1.050e+00  1.411e+00  0.744  0.456918
## PARISHKyandahi              4.283e-01  7.408e-01  0.578  0.563238
## PARISHMirama                -1.490e+00 4.320e+00 -0.345  0.730256
## PARISHMirongo               -4.491e-01 8.657e-01 -0.519  0.603988
## PARISHMitoozo               1.010e+00  7.481e-01  1.350  0.177116
## PARISHNcune                  2.085e+00  8.080e-01  2.580  0.009944 **
## PARISHNdeija                 NA          NA          NA          NA
## PARISHNgango                 2.064e+00  7.482e-01  2.759  0.005849 **
## PARISHNgoma                 -2.198e+00 7.303e-01 -3.010  0.002642 **
## PARISHNgugo                 -5.808e-01 7.435e-01 -0.781  0.434776
## PARISHNsinka                 NA          NA          NA          NA
## PARISHNtuura                 -1.114e+00 4.319e+00 -0.258  0.796505
## PARISHNyabikungu             NA          NA          NA          NA
## PARISHNyabisirira            NA          NA          NA          NA
## PARISHNyaihangaa              NA          NA          NA          NA
## PARISHNyakabare               3.065e+00  9.382e-01  3.267  0.001105 **
## PARISHNyakaikara              -4.627e+00 8.064e-01 -5.737  1.10e-08 ***
## PARISHNyanja                  7.435e-01 2.206e+00  0.337  0.736097
## PARISHNyarubungo_Bwizibwera  7.276e-01 4.325e+00  0.168  0.866416
## PARISHNyarubungo_Ndija        NA          NA          NA          NA
## PARISHNyaruhandagazi         NA          NA          NA          NA
## PARISHOther                   NA          NA          NA          NA
## PARISHRubingo                 NA          NA          NA          NA
## PARISHRukarabo                 NA          NA          NA          NA
## PARISHRweibogo                 NA          NA          NA          NA
## PARISHRwensinga                NA          NA          NA          NA
## PARISHRyamiyonga                NA          NA          NA          NA
## ASSET_TOTAL                   5.333e-04  8.629e-05  6.181  7.67e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.285 on 2074 degrees of freedom
##   (109 observations deleted due to missingness)
## Multiple R-squared:  0.6031, Adjusted R-squared:  0.5945
## F-statistic: 70.03 on 45 and 2074 DF,  p-value: < 2.2e-16

#### Time payment
lm4 = lm(MAXBIDNOVEL ~ Improves_Health+Time_Money+Time_Money_Health+DATESURVEY+PARISH+ASSET_TOTAL- 1, data=dat)
summary(lm4)

```

```

##
## Call:
## lm(formula = MAXBIDNOVEL ~ Improves_Health + Time_Money + Time_Money_Health +
##      DATESURVEY + PARISH + ASSET_TOTAL - 1, data = data_plus,
##      na.action = na.omit)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -12.822 -2.882 -1.191   1.422  74.767
##
## Coefficients: (17 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)
## Improves_Health          0.0024081  0.3651410  0.007 0.994739
## Time_Money                 0.6055864  0.3623862  1.671 0.094851 .
## Time_Money_Health        -0.1424853  0.3603553 -0.395 0.692587
## DATESURVEY01-Feb-12       4.7253017  0.8602629  5.493 4.44e-08 ***
## DATESURVEY01-Mar-12       4.8986774  0.7627074  6.423 1.65e-10 ***
## DATESURVEY02-Feb-12       5.1292132  0.8664440  5.920 3.76e-09 ***
## DATESURVEY03-Feb-12       7.3613013  0.8600079  8.560 < 2e-16 ***
## DATESURVEY06-Feb-12       9.6123848  0.9394088 10.232 < 2e-16 ***
## DATESURVEY07-Feb-12       5.9896237  0.7714762  7.764 1.28e-14 ***
## DATESURVEY08-Feb-12       12.4824706 0.8222511 15.181 < 2e-16 ***
## DATESURVEY09-Feb-12       9.2374227  0.9634378  9.588 < 2e-16 ***
## DATESURVEY10-Feb-12       10.1147888 0.89998969 11.240 < 2e-16 ***
## DATESURVEY14-Feb-12       4.9865584  1.7247294  2.891 0.003877 **
## DATESURVEY15-Feb-12       4.3472749  0.8062337  5.392 7.75e-08 ***
## DATESURVEY16-Feb-12       7.2811962  2.9900232  2.435 0.014968 *
## DATESURVEY17-Feb-12       4.0444435  5.9289467  0.682 0.495219
## DATESURVEY21-Feb-12       3.3402693  5.9290832  0.563 0.573243
## DATESURVEY22-Feb-12       2.8907265  0.7246094  3.989 6.85e-05 ***
## DATESURVEY23-Feb-12       3.7408549  0.8597101  4.351 1.42e-05 ***
## DATESURVEY24-Feb-12       6.1307550  0.8112888  7.557 6.15e-14 ***
## DATESURVEY27-Feb-12       0.8756296  5.9301486  0.148 0.882628
## DATESURVEY28-Feb-12       7.7048589  0.7355003 10.476 < 2e-16 ***
## DATESURVEY29-Feb-12       6.6523759  0.7447018  8.933 < 2e-16 ***
## DATESURVEY31-Jan-12       3.5549005  0.7958448  4.467 8.36e-06 ***
## PARISHBukiro               3.0466213  3.0736829  0.991 0.321705
## PARISHBwengure              6.0263188  5.9645013  1.010 0.312438
## PARISHKabarama             5.1613919  1.0813576  4.773 1.94e-06 ***
## PARISHKakigaani            -3.8530643  1.2397036 -3.108 0.001909 **
## PARISHKamomo                -1.1385999  1.1033942 -1.032 0.302236
## PARISHKibingo_Bugamba        NA          NA          NA          NA
## PARISHKibingo_Kagogi        NA          NA          NA          NA
## PARISHkigaaga              1.8217728  1.0877587  1.675 0.094125 .
## PARISHKitojo                  NA          NA          NA          NA
## PARISHKitunguru             2.0317344  1.9374269  1.049 0.294449
## PARISHKongoro                -0.3692633  1.0308697 -0.358 0.720226
## PARISHKyandahi              -0.7949181  5.9677999 -0.133 0.894047
## PARISHMirama                -1.1969306  1.1762817 -1.018 0.309008
## PARISHMirongo                1.3337276  1.0276593  1.298 0.194489
## PARISHMitoozo                1.9547290  1.1367059  1.720 0.085646 .
## PARISHNcune                  NA          NA          NA          NA
## PARISHNdeija                  NA          NA          NA          NA
## PARISHNgango                3.6836259  1.0238550  3.598 0.000328 ***

```

```

## PARISHNgoma          -3.9839844  1.0012604 -3.979 7.16e-05 ***
## PARISHNgugo          -0.6883381  1.0438959 -0.659 0.509716
## PARISHNsinka         NA          NA          NA          NA
## PARISHNtuura         0.2095978  5.9649381  0.035 0.971973
## PARISHNyabikungu    NA          NA          NA          NA
## PARISHNyabisirira   NA          NA          NA          NA
## PARISHNyaihangha    NA          NA          NA          NA
## PARISHNyakabare     3.1066904  1.2874745  2.413 0.015907 *
## PARISHNyakaikara   -5.3491348  1.1185386 -4.782 1.85e-06 ***
## PARISHNyanja        -2.2522386  3.0457677 -0.739 0.459708
## PARISHNyarubungo_Bwizibwera 2.6001719  5.9695147  0.436 0.663190
## PARISHNyarubungo_Ndijia  NA          NA          NA          NA
## PARISHNyaruhandagazi NA          NA          NA          NA
## PARISHOOther         NA          NA          NA          NA
## PARISHRubingo       NA          NA          NA          NA
## PARISHRukarabo      NA          NA          NA          NA
## PARISHRweibogo      NA          NA          NA          NA
## PARISHRwensinga     NA          NA          NA          NA
## PARISHRyamiyonga    NA          NA          NA          NA
## ASSET_TOTAL          0.0006298  0.0001196  5.267 1.53e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.918 on 2084 degrees of freedom
##   (99 observations deleted due to missingness)
## Multiple R-squared:  0.6079, Adjusted R-squared:  0.5994
## F-statistic: 71.78 on 45 and 2084 DF,  p-value: < 2.2e-16

```

```
data.frame(summary(lm1)$coefficients[2:4, c(1,2,4)])
```

```

##                   Estimate Std. Error Pr...t..
## Improves_Health  0.9197150  0.2839692 0.001219001
## Time_Money      -0.1083085  0.2860865 0.705032926
## Time_Money_Health 0.2956404  0.2819550 0.294510931

```

```
data.frame(summary(lm2)$coefficients[2:4, c(1,2,4)])
```

```

##                   Estimate Std. Error Pr...t..
## Improves_Health  0.07767669 0.3932248 0.8434257
## Time_Money       0.42168403 0.3897955 0.2794605
## Time_Money_Health -0.12090453 0.3881558 0.7554629

```

```
data.frame(summary(lm3)$coefficients[1:3, c(1,2,4)])
```

```

##                   Estimate Std. Error Pr...t..
## Improves_Health  0.9679326 0.2627484 0.0002355969
## Time_Money       0.0838382 0.2651367 0.7518769044
## Time_Money_Health 0.3294861 0.2608302 0.2066518648

```

```
data.frame(summary(lm4)$coefficients[1:3, c(1,2,4)])
```

```

##          Estimate Std..Error   Pr...t..
## Improves_Health    0.002408093  0.3651410  0.99473865
## Time_Money        0.605586410  0.3623862  0.09485055
## Time_Money_Health -0.142485272  0.3603553  0.69258655

```

## 5.2 Multiple regression + HH level controls + Total Asset [District FE + Survey Date FE + ]

We leave out LUNCHYESTERDAY, TYPICALNUMEATING\_Dummy, and HOWPAID, which make the group message effect dramatically insignificant.

```

# library(plm)
# lm2 <- plm(MAXBID ~ No_message+Improves_Health+Time_Money_Health+Time_Money+Time_Money_Health+FEMALE+AGE+MARRIED+WIFECOOK+JOINTDECISION+DATESURVEY+PARISH+ASSET_TOTAL-1, data = data_plus,
#               data = data_plus,
#               index = c("DATESURVEY", "UNIQUE_HHID"),
#               model = "within")
# summary(lm2)

lm5 = lm(MAXBID ~ Improves_Health + Time_Money + Time_Money_Health+ FEMALE+AGE+MARRIED+KNOWLUNCH_Dummy+WIFECOOK+JOINTDECISION+DATESURVEY+PARISH+ASSET_TOTAL-1, data = data_plus)
summary(lm5)

##
## Call:
## lm(formula = MAXBID ~ Improves_Health + Time_Money + Time_Money_Health +
##     FEMALE + AGE + MARRIED + KNOWLUNCH_Dummy + WIFECOOK + JOINTDECISION +
##     DATESURVEY + PARISH + ASSET_TOTAL - 1, data = data_plus)
##
## Residuals:
##      Min    1Q Median    3Q   Max 
## -9.779 -2.231 -0.754  1.103 73.973 
##
## Coefficients: (17 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)    
## Improves_Health    9.521e-01  2.633e-01   3.616 0.000306 ***
## Time_Money        2.768e-01  2.718e-01   1.019 0.308533    
## Time_Money_Health 3.378e-01  2.600e-01   1.299 0.194032    
## FEMALE           -1.234e+00  2.383e-01  -5.178 2.46e-07 ***
## AGE              -1.395e-02  7.119e-03  -1.959 0.050226 .  
## MARRIED          2.625e-01  2.771e-01   0.947 0.343499    
## KNOWLUNCH_Dummy  8.229e-01  3.452e-01   2.384 0.017226 *  
## WIFECOOK         -1.408e-01  3.150e-01  -0.447 0.654988    
## JOINTDECISION    5.298e-02  2.143e-01   0.247 0.804781    
## DATESURVEY01-Feb-12 5.030e+00  7.972e-01   6.309 3.42e-10 ***
## DATESURVEY01-Mar-12 3.554e+00  7.420e-01   4.790 1.79e-06 ***
## DATESURVEY02-Feb-12 3.494e+00  7.947e-01   4.397 1.16e-05 ***
## DATESURVEY03-Feb-12 5.198e+00  7.760e-01   6.699 2.70e-11 *** 
## DATESURVEY06-Feb-12 7.649e+00  8.322e-01   9.190  < 2e-16 ***
## DATESURVEY07-Feb-12 4.350e+00  7.586e-01   5.734 1.12e-08 ***
## DATESURVEY08-Feb-12 9.112e+00  7.808e-01  11.670  < 2e-16 ***
## DATESURVEY09-Feb-12 7.451e+00  8.694e-01   8.570  < 2e-16 *** 
## DATESURVEY10-Feb-12 7.626e+00  8.306e-01   9.181  < 2e-16 *** 
## DATESURVEY14-Feb-12 4.318e+00  1.345e+00   3.210 0.001349 **
```

```

## DATESURVEY15-Feb-12      3.093e+00  7.610e-01  4.064 5.00e-05 ***
## DATESURVEY16-Feb-12      2.311e+00  2.213e+00  1.044 0.296606
## DATESURVEY17-Feb-12      5.194e+00  4.289e+00  1.211 0.226054
## DATESURVEY21-Feb-12      4.314e+00  4.288e+00  1.006 0.314559
## DATESURVEY22-Feb-12      2.824e+00  7.322e-01  3.858 0.000118 ***
## DATESURVEY23-Feb-12      2.301e+00  7.907e-01  2.910 0.003658 **
## DATESURVEY24-Feb-12      4.160e+00  7.801e-01  5.332 1.07e-07 ***
## DATESURVEY27-Feb-12      3.335e+00  4.289e+00  0.778 0.436873
## DATESURVEY28-Feb-12      5.145e+00  7.222e-01  7.124 1.44e-12 ***
## DATESURVEY29-Feb-12      4.827e+00  7.454e-01  6.476 1.18e-10 ***
## DATESURVEY31-Jan-12      2.870e+00  7.447e-01  3.853 0.000120 ***
## PARISHBukiro              5.028e+00  2.214e+00  2.271 0.023264 *
## PARISHBwengure             2.208e+00  4.305e+00  0.513 0.607973
## PARISHKabarama             4.114e+00  7.803e-01  5.273 1.48e-07 ***
## PARISHKakigaani            -3.446e+00 9.025e-01 -3.818 0.000138 ***
## PARISHKamomo               -2.480e+00 7.933e-01 -3.126 0.001797 **
## PARISHKibingo_Bugamba      NA          NA          NA          NA
## PARISHKibingo_Kagogi       NA          NA          NA          NA
## PARISHKigaaga              2.348e+00  8.016e-01  2.929 0.003442 **
## PARISHKitojo                NA          NA          NA          NA
## PARISHKitunguru            1.248e+00  1.402e+00  0.890 0.373669
## PARISHKongoro              2.656e-01  7.376e-01  0.360 0.718834
## PARISHKyandahi              -1.968e+00 4.311e+00 -0.456 0.648146
## PARISHMirama                -5.039e-01 8.598e-01 -0.586 0.557896
## PARISHMirongo              1.080e+00  7.455e-01  1.448 0.147721
## PARISHMitoozo              2.266e+00  8.065e-01  2.810 0.005001 **
## PARISHNcune                  NA          NA          NA          NA
## PARISHNdeija                 NA          NA          NA          NA
## PARISHNgango                2.002e+00  7.431e-01  2.694 0.007125 **
## PARISHNgoma                 -2.091e+00 7.262e-01 -2.879 0.004027 **
## PARISHNgugo                 -6.622e-01 7.393e-01 -0.896 0.370548
## PARISHNsinka                 NA          NA          NA          NA
## PARISHNtuura                -2.093e+00 4.299e+00 -0.487 0.626422
## PARISHNyabikungu             NA          NA          NA          NA
## PARISHNyabisirira            NA          NA          NA          NA
## PARISHNyaihangaa             NA          NA          NA          NA
## PARISHNyakabare              3.347e+00  9.359e-01  3.577 0.000356 ***
## PARISHNyakaikara             -4.431e+00 8.032e-01 -5.517 3.88e-08 ***
## PARISHNyanja                 6.646e-01  2.193e+00  0.303 0.761875
## PARISHNyarubungo_Bwizibwera -3.635e-01 4.308e+00 -0.084 0.932757
## PARISHNyarubungo_Ndija       NA          NA          NA          NA
## PARISHNyaruhandagazi        NA          NA          NA          NA
## PARISHOther                   NA          NA          NA          NA
## PARISHRubingo                 NA          NA          NA          NA
## PARISHRukarabo                NA          NA          NA          NA
## PARISHRweibogo                NA          NA          NA          NA
## PARISHRwensinga               NA          NA          NA          NA
## PARISHRyamiyongaa             NA          NA          NA          NA
## ASSET_TOTAL                  5.211e-04  8.659e-05  6.018 2.09e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.253 on 2068 degrees of freedom
##   (109 observations deleted due to missingness)

```

```
## Multiple R-squared:  0.6102, Adjusted R-squared:  0.6006
## F-statistic: 63.48 on 51 and 2068 DF,  p-value: < 2.2e-16
```

```
lm6 = lm(MAXBIDNOVEL ~ Improves_Health + Time_Money + Time_Money_Health+ FEMALE+AGE+MARRIED+KNOWLUNCH_Dum
summary(lm6)
```

```
##
## Call:
## lm(formula = MAXBIDNOVEL ~ Improves_Health + Time_Money + Time_Money_Health +
##      FEMALE + AGE + MARRIED + KNOWLUNCH_Dummy + WIFECOOK + JOINTDECISION +
##      DATESURVEY + PARISH + ASSET_TOTAL - 1, data = data_plus)
##
## Residuals:
##    Min     1Q Median     3Q    Max 
## -12.933 -2.939 -1.077  1.407 73.236 
##
## Coefficients: (17 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)    
## Improves_Health -0.0633822 0.3655915 -0.173 0.862378  
## Time_Money       0.9409219 0.3708898  2.537 0.011255 *   
## Time_Money_Health -0.1178736 0.3588320 -0.328 0.742573  
## FEMALE          -1.8118971 0.3284200 -5.517 3.88e-08 ***  
## AGE             -0.0173229 0.0097556 -1.776 0.075932 .  
## MARRIED         0.4405176 0.3814111  1.155 0.248236  
## KNOWLUNCH_Dummy 1.4230699 0.4710051  3.021 0.002547 **  
## WIFECOOK        0.0456895 0.4309035  0.106 0.915567  
## JOINTDECISION   -0.0015227 0.2952648 -0.005 0.995886  
## DATESURVEY01-Feb-12 4.9734281 1.1044849  4.503 7.07e-06 ***  
## DATESURVEY01-Mar-12 4.8377502 1.0194489  4.745 2.22e-06 ***  
## DATESURVEY02-Feb-12 4.7256901 1.0958517  4.312 1.69e-05 ***  
## DATESURVEY03-Feb-12 7.0037935 1.0699727  6.546 7.43e-11 ***  
## DATESURVEY06-Feb-12 9.7620324 1.1559749  8.445 < 2e-16 ***  
## DATESURVEY07-Feb-12 6.3837739 1.0491339  6.085 1.38e-09 ***  
## DATESURVEY08-Feb-12 12.5860249 1.0755222 11.702 < 2e-16 ***  
## DATESURVEY09-Feb-12 9.6803941 1.1895280  8.138 6.84e-16 ***  
## DATESURVEY10-Feb-12 10.8013442 1.1322295  9.540 < 2e-16 ***  
## DATESURVEY14-Feb-12 5.1979075 1.8557192  2.801 0.005141 **  
## DATESURVEY15-Feb-12 4.4836065 1.0415277  4.305 1.75e-05 ***  
## DATESURVEY16-Feb-12 7.4801146 3.0532544  2.450 0.014372 *  
## DATESURVEY17-Feb-12 6.0418452 5.9178352  1.021 0.307394  
## DATESURVEY21-Feb-12 5.0195527 5.9155494  0.849 0.396238  
## DATESURVEY22-Feb-12 3.5917256 1.0083124  3.562 0.000376 ***  
## DATESURVEY23-Feb-12 3.6726596 1.1110555  3.306 0.000964 ***  
## DATESURVEY24-Feb-12 6.3453714 1.0679747  5.941 3.30e-09 ***  
## DATESURVEY27-Feb-12 3.3697968 5.9157165  0.570 0.568987  
## DATESURVEY28-Feb-12 7.9137077 0.9896923  7.996 2.11e-15 ***  
## DATESURVEY29-Feb-12 6.7062435 1.0108920  6.634 4.15e-11 ***  
## DATESURVEY31-Jan-12 3.6898845 1.0259552  3.597 0.000330 ***  
## PARISHBukiro      3.1721137 3.0513975  1.040 0.298665  
## PARISHBwengure    4.7675104 5.9371734  0.803 0.422070  
## PARISHKabarama   5.4444055 1.0766440  5.057 4.64e-07 ***  
## PARISHKakigaani -3.8157464 1.2310963 -3.099 0.001965 **  
## PARISHKamomo     -1.5746063 1.1003155 -1.431 0.152566  
## PARISHKibingo_Bugamba NA      NA      NA      NA      NA
```

```

## PARISHKibingo_Kagogi NA NA NA NA
## PARISHKigaaga 2.1995346 1.0854747 2.026 0.042858 *
## PARISHKitojo NA NA NA NA
## PARISHKitunguru 2.3594361 1.9242500 1.226 0.220278
## PARISHKongoro -0.5872863 1.0252529 -0.573 0.566828
## PARISHKyandahi -2.0170104 5.9486227 -0.339 0.734590
## PARISHMirama -1.3307817 1.1673242 -1.140 0.254406
## PARISHMirongo 1.4465139 1.0233867 1.413 0.157671
## PARISHMitoozo 2.2653885 1.1337298 1.998 0.045828 *
## PARISHNcune NA NA NA NA
## PARISHNdeija NA NA NA NA
## PARISHNgango 3.6039343 1.0157546 3.548 0.000397 ***
## PARISHNgoma -3.8439824 0.9950159 -3.863 0.000115 ***
## PARISHNgugo -0.8439354 1.0370430 -0.814 0.415858
## PARISHNsinka NA NA NA NA
## PARISHNtuura -1.3993883 5.9304094 -0.236 0.813481
## PARISHNyabikungu NA NA NA NA
## PARISHNyabisirira NA NA NA NA
## PARISHNyaihang NA NA NA NA
## PARISHNyakabare 3.5485779 1.2829231 2.766 0.005725 **
## PARISHNyakaikara -5.0647907 1.1129100 -4.551 5.65e-06 ***
## PARISHNyanya -2.3542127 3.0254152 -0.778 0.436572
## PARISHNyarubungo_Bwizibwera 0.8114014 5.9399466 0.137 0.891360
## PARISHNyarubungo_Ndiija NA NA NA NA
## PARISHNyaruhandagazi NA NA NA NA
## PARISHOther NA NA NA NA
## PARISHRubingo NA NA NA NA
## PARISHRukarabo NA NA NA NA
## PARISHRweibogo NA NA NA NA
## PARISHRwensinga NA NA NA NA
## PARISHRyamiyonga NA NA NA NA
## ASSET_TOTAL 0.0006138 0.0001199 5.120 3.34e-07 ***
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.867 on 2078 degrees of freedom
##   (99 observations deleted due to missingness)
## Multiple R-squared: 0.6156, Adjusted R-squared: 0.6062
## F-statistic: 65.26 on 51 and 2078 DF, p-value: < 2.2e-16

```

```
data.frame(summary(lm5)$coefficients[1:9, c(1,2,4)])
```

```

##                   Estimate Std. Error Pr...t..
## Improves_Health 0.95207105 0.263302007 3.064829e-04
## Time_Money      0.27681186 0.271769195 3.085334e-01
## Time_Money_Health 0.33776803 0.259988269 1.940316e-01
## FEMALE        -1.23409475 0.238343629 2.462799e-07
## AGE           -0.01394799 0.007119304 5.022603e-02
## MARRIED       0.26253089 0.277079680 3.434986e-01
## KNOWLUNCH_Dummy 0.82293437 0.345223675 1.722598e-02
## WIFECOOK      -0.14077940 0.315007772 6.549885e-01
## JOINTDECISION 0.05298059 0.214326070 8.047809e-01

```

```
data.frame(summary(lm6)$coefficients[1:9, c(1,2,4)])
```

```
##                   Estimate Std. Error Pr...t...
## Improves_Health -0.06338218 0.365591525 8.623784e-01
## Time_Money       0.94092194 0.370889824 1.125548e-02
## Time_Money_Health -0.11787356 0.358832029 7.425726e-01
## FEMALE          -1.81189710 0.328420028 3.878265e-08
## AGE              -0.01732289 0.009755645 7.593214e-02
## MARRIED          0.44051755 0.381411080 2.482364e-01
## KNOWLUNCH_Dummy  1.42306995 0.471005103 2.547228e-03
## WIFECOOK          0.04568949 0.430903512 9.155673e-01
## JOINTDECISION    -0.00152270 0.295264846 9.958858e-01
```

### 5.3 Multiple regression + Wealth level controls [District FE + Survey Date FE]

We ignore TIME\_EMPLOYED, SELFEMPLOYED as they are not significant. Since almost all the asset dummies are significant, we do two ways, one is with original dummies, another is with the created total asset variable.

Use the dummies.

```
lm7 = lm(MAXBID ~ Improves_Health + Time_Money + Time_Money_Health+HH_PHONES+INCOME_Dummy+BICYCLE_DUMMY+
summary(lm7)
```

```
##
## Call:
## lm(formula = MAXBID ~ Improves_Health + Time_Money + Time_Money_Health +
##     HH_PHONES + INCOME_Dummy + BICYCLE_DUMMY + CAR_DUMMY + MOTORCYCLE_DUMMY +
##     RADIO_DUMMY + COWS_Dummy + TV_Dummy + SELFEMPLOYED + TIME_EMPLOYED +
##     DATESURVEY + PARISH - 1, data = data_plus, na.action = na.omit)
##
## Residuals:
##      Min      1Q Median      3Q      Max 
## -8.949 -2.249 -0.791  1.123  74.916 
##
## Coefficients: (17 not defined because of singularities)
##                   Estimate Std. Error t value Pr(>|t|)    
## Improves_Health      1.11775   0.27375   4.083 4.61e-05 ***
## Time_Money            0.22394   0.27197   0.823 0.410381  
## Time_Money_Health     0.36497   0.26726   1.366 0.172219  
## HH_PHONES             0.30078   0.14671   2.050 0.040474 *  
## INCOME_Dummy          0.92402   0.37481   2.465 0.013769 *  
## BICYCLE_DUMMY         0.20943   0.20139   1.040 0.298488  
## CAR_DUMMY              0.82097   0.77388   1.061 0.288879  
## MOTORCYCLE_DUMMY      1.05925   0.32091   3.301 0.000981 *** 
## RADIO_DUMMY            0.20062   0.31709   0.633 0.527009  
## COWS_Dummy              0.37185   0.22223   1.673 0.094429 .  
## TV_Dummy                0.86061   0.46109   1.866 0.062116 .  
## SELFEMPLOYED           -0.22008   0.25024  -0.879 0.379250  
## TIME_EMPLOYED           -0.04065   0.21927  -0.185 0.852954  
## DATESURVEY01-Feb-12     3.40182   0.71364   4.767 2.00e-06 *** 
## DATESURVEY01-Mar-12     1.97037   0.68660   2.870 0.004150 **
```

## DATESURVEY02-Feb-12	2.37962	0.73878	3.221	0.001297	**
## DATESURVEY03-Feb-12	3.78656	0.72233	5.242	1.75e-07	***
## DATESURVEY06-Feb-12	5.72041	0.78392	7.297	4.17e-13	***
## DATESURVEY07-Feb-12	2.58224	0.64869	3.981	7.11e-05	***
## DATESURVEY08-Feb-12	7.36519	0.70957	10.380	< 2e-16	***
## DATESURVEY09-Feb-12	5.53560	0.80492	6.877	8.06e-12	***
## DATESURVEY10-Feb-12	5.66581	0.75553	7.499	9.49e-14	***
## DATESURVEY14-Feb-12	2.64553	1.30994	2.020	0.043556	*
## DATESURVEY15-Feb-12	1.34978	0.70929	1.903	0.057180	.
## DATESURVEY16-Feb-12	1.05865	2.19767	0.482	0.630060	
## DATESURVEY17-Feb-12	2.23705	4.31318	0.519	0.604057	
## DATESURVEY21-Feb-12	1.57220	4.31751	0.364	0.715788	
## DATESURVEY22-Feb-12	0.70502	0.64957	1.085	0.277881	
## DATESURVEY23-Feb-12	0.88508	0.71466	1.238	0.215686	
## DATESURVEY24-Feb-12	2.41125	0.71190	3.387	0.000720	***
## DATESURVEY27-Feb-12	0.18693	4.32203	0.043	0.965505	
## DATESURVEY28-Feb-12	3.46523	0.65259	5.310	1.21e-07	***
## DATESURVEY29-Feb-12	3.32509	0.66867	4.973	7.15e-07	***
## DATESURVEY31-Jan-12	1.10323	0.67963	1.623	0.104682	
## PARISHBukiro	4.44272	2.23153	1.991	0.046625	*
## PARISHBwengure	3.09919	4.32517	0.717	0.473734	
## PARISHKabarama	3.63166	0.78772	4.610	4.27e-06	***
## PARISHKakigaani	-3.44719	0.90925	-3.791	0.000154	***
## PARISHKamomo	-2.30069	0.79741	-2.885	0.003952	**
## PARISHKibingo_Bugamba	NA	NA	NA	NA	
## PARISHKibingo_Kagogi	NA	NA	NA	NA	
## PARISHKigaaga	1.91972	0.80495	2.385	0.017173	*
## PARISHKitojo	NA	NA	NA	NA	
## PARISHKitunguru	0.84906	1.41145	0.602	0.547538	
## PARISHKongoro	0.43086	0.74312	0.580	0.562120	
## PARISHKyandahi	-1.12703	4.32615	-0.261	0.794492	
## PARISHMirama	-0.62802	0.87052	-0.721	0.470731	
## PARISHMirongo	0.85647	0.75026	1.142	0.253765	
## PARISHMitoozo	2.00554	0.81235	2.469	0.013637	*
## PARISHNcune	NA	NA	NA	NA	
## PARISHNdeija	NA	NA	NA	NA	
## PARISHNgango	2.07019	0.75310	2.749	0.006032	**
## PARISHNgoma	-2.20556	0.73281	-3.010	0.002646	**
## PARISHNgugo	-0.41064	0.74571	-0.551	0.581920	
## PARISHNsinka	NA	NA	NA	NA	
## PARISHNtuura	-1.10349	4.31975	-0.255	0.798399	
## PARISHNyabikungu	NA	NA	NA	NA	
## PARISHNyabisirira	NA	NA	NA	NA	
## PARISHNyaihang'a	NA	NA	NA	NA	
## PARISHNyakabare	3.17844	0.94216	3.374	0.000756	***
## PARISHNyakaikara	-4.63942	0.80861	-5.737	1.10e-08	***
## PARISHNyanya	0.15426	2.20794	0.070	0.944308	
## PARISHNyarubungo_Bwizibwera	0.74334	4.32604	0.172	0.863589	
## PARISHNyarubungo_Ndiija	NA	NA	NA	NA	
## PARISHNyaruhandagazi	NA	NA	NA	NA	
## PARISHOther	NA	NA	NA	NA	
## PARISHRubingo	NA	NA	NA	NA	
## PARISHRukarabo	NA	NA	NA	NA	
## PARISHRweibogo	NA	NA	NA	NA	

```

## PARISHRwensinga           NA          NA          NA          NA
## PARISHRyamiyonga          NA          NA          NA          NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.282 on 2065 degrees of freedom
##   (109 observations deleted due to missingness)
## Multiple R-squared:  0.6054, Adjusted R-squared:  0.5951
## F-statistic: 58.68 on 54 and 2065 DF,  p-value: < 2.2e-16

lm8 = lm(MAXBIDNOVEL ~ Improves_Health + Time_Money + Time_Money_Health+HH_PHONES+INCOME_Dummy+BICYCLE_DUMMY+CAR_DUMMY+MOTORCYCLE_DUMMY+RADIO_DUMMY+COWS_Dummy+TV_Dummy+SELFEMPLOYED+TIME_EMPLOYED+DATESURVEY+PARISH - 1, data = data_plus, na.action = na.omit)
summary(lm8)

```

```

##
## Call:
## lm(formula = MAXBIDNOVEL ~ Improves_Health + Time_Money + Time_Money_Health +
##     HH_PHONES + INCOME_Dummy + BICYCLE_DUMMY + CAR_DUMMY + MOTORCYCLE_DUMMY +
##     RADIO_DUMMY + COWS_Dummy + TV_Dummy + SELFEMPLOYED + TIME_EMPLOYED +
##     DATESURVEY + PARISH - 1, data = data_plus, na.action = na.omit)
##
## Residuals:
##    Min      1Q  Median      3Q      Max
## -12.215  -2.853  -1.169   1.348  74.675
##
## Coefficients: (17 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)
## Improves_Health          0.19776  0.37961  0.521  0.602460
## Time_Money                0.79384  0.37102  2.140  0.032503 *
## Time_Money_Health        -0.11036  0.36862 -0.299  0.764679
## HH_PHONES                 0.39750  0.20251  1.963  0.049789 *
## INCOME_Dummy               1.39411  0.51248  2.720  0.006576 **
## BICYCLE_DUMMY              0.42523  0.27713  1.534  0.125078
## CAR_DUMMY                  0.79285  1.08430  0.731  0.464734
## MOTORCYCLE_DUMMY            1.26874  0.44230  2.869  0.004166 **
## RADIO_DUMMY                 0.40628  0.43400  0.936  0.349309
## COWS_Dummy                  0.34670  0.30628  1.132  0.257774
## TV_Dummy                     1.34569  0.63507  2.119  0.034211 *
## SELFEMPLOYED                -0.42449  0.34221 -1.240  0.214949
## TIME_EMPLOYED                -0.01291  0.30137 -0.043  0.965840
## DATESURVEY01-Feb-12         3.07450  0.98931  3.108  0.001911 **
## DATESURVEY01-Mar-12         2.97535  0.94022  3.165  0.001576 **
## DATESURVEY02-Feb-12         3.51864  1.01607  3.463  0.000545 ***
## DATESURVEY03-Feb-12         5.33823  0.99364  5.372  8.64e-08 ***
## DATESURVEY06-Feb-12         7.42816  1.08556  6.843  1.02e-11 ***
## DATESURVEY07-Feb-12         4.24887  0.89766  4.733  2.36e-06 ***
## DATESURVEY08-Feb-12         10.44709 0.97811 10.681 < 2e-16 ***
## DATESURVEY09-Feb-12         7.39606  1.09187  6.774  1.63e-11 ***
## DATESURVEY10-Feb-12         8.39918  1.02059  8.230  3.27e-16 ***
## DATESURVEY14-Feb-12         3.15769  1.80407  1.750  0.080212 .
## DATESURVEY15-Feb-12         2.42649  0.96098  2.525  0.011643 *
## DATESURVEY16-Feb-12         6.02753  3.02757  1.991  0.046625 *
## DATESURVEY17-Feb-12         1.90076  5.94326  0.320  0.749138
## DATESURVEY21-Feb-12         0.99731  5.94925  0.168  0.866885
## DATESURVEY22-Feb-12         0.93118  0.89299  1.043  0.297178

```

```

## DATESURVEY23-Feb-12      2.10245   1.00091   2.101  0.035802 *
## DATESURVEY24-Feb-12      4.21231   0.97325   4.328  1.58e-05 ***
## DATESURVEY27-Feb-12     -0.92588   5.95545  -0.155  0.876468
## DATESURVEY28-Feb-12      5.93913   0.89236   6.656  3.60e-11 ***
## DATESURVEY29-Feb-12      4.95362   0.90208   5.491  4.48e-08 ***
## DATESURVEY31-Jan-12      1.53267   0.93489   1.639  0.101280
## PARISHBukiro              2.34420   3.07151   0.763  0.445427
## PARISHBwengure             6.47544   5.95945   1.087  0.277347
## PARISHKabarama            4.75526   1.08579   4.380  1.25e-05 ***
## PARISHKakigaani           -3.83405   1.23883  -3.095  0.001995 **
## PARISHKamomo               -1.36631   1.10524  -1.236  0.216520
## PARISHKibingo_Bugamba      NA         NA         NA         NA
## PARISHKibingo_Kagogi       NA         NA         NA         NA
## PARISHKigaaga              1.60540   1.08925   1.474  0.140669
## PARISHKitojo                NA         NA         NA         NA
## PARISHKitunguru            1.76642   1.93423   0.913  0.361219
## PARISHKongoro              -0.34444   1.03163  -0.334  0.738506
## PARISHKyandahi              -0.18489   5.96334  -0.031  0.975269
## PARISHMirama                -1.55463   1.18040  -1.317  0.187972
## PARISHMirongo              1.14709   1.02828   1.116  0.264745
## PARISHMitoozo              1.77127   1.13952   1.554  0.120240
## PARISHNcune                  NA         NA         NA         NA
## PARISHNdeija                 NA         NA         NA         NA
## PARISHNgango                 3.78614   1.02812   3.683  0.000237 ***
## PARISHNgoma                 -3.98444   1.00239  -3.975  7.28e-05 ***
## PARISHNgugo                 -0.48263   1.04529  -0.462  0.644332
## PARISHNsinka                  NA         NA         NA         NA
## PARISHNtuura                 0.31838   5.95272   0.053  0.957351
## PARISHNyabikungu             NA         NA         NA         NA
## PARISHNyabisirira            NA         NA         NA         NA
## PARISHNyaihangaa              NA         NA         NA         NA
## PARISHNyakabare              3.20252   1.29016   2.482  0.013133 *
## PARISHNyakaikara             -5.28603   1.11854  -4.726  2.45e-06 ***
## PARISHNyanja                 -3.08632   3.04249  -1.014  0.310507
## PARISHNyarubungo_Bwizibwera  2.69746   5.95834   0.453  0.650797
## PARISHNyarubungo_Ndiija        NA         NA         NA         NA
## PARISHNyaruhandagazi          NA         NA         NA         NA
## PARISHOther                   NA         NA         NA         NA
## PARISHRubingo                  NA         NA         NA         NA
## PARISHRukarabo                  NA         NA         NA         NA
## PARISHRweibogo                  NA         NA         NA         NA
## PARISHRwensinga                  NA         NA         NA         NA
## PARISHRyamiyonga                  NA         NA         NA         NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.901 on 2075 degrees of freedom
##   (99 observations deleted due to missingness)
## Multiple R-squared:  0.6118, Adjusted R-squared:  0.6017
## F-statistic: 60.56 on 54 and 2075 DF,  p-value: < 2.2e-16

```

```
data.frame(summary(lm7)$coefficients[1:13, c(1,2,4)])
```

##	Estimate	Std..Error	Pr...t..
----	----------	------------	----------

```

## Improves_Health    1.11774983  0.2737451 4.611763e-05
## Time_Money         0.22393995  0.2719730 4.103812e-01
## Time_Money_Health  0.36496554  0.2672603 1.722194e-01
## HH_PHONES          0.30078152  0.1467109 4.047442e-02
## INCOME_Dummy       0.92402487  0.3748062 1.376910e-02
## BICYCLE_DUMMY     0.20942933  0.2013852 2.984876e-01
## CAR_DUMMY          0.82097219  0.7738757 2.888785e-01
## MOTORCYCLE_DUMMY   1.05925212  0.3209079 9.805205e-04
## RADIO_DUMMY        0.20061846  0.3170906 5.270094e-01
## COWS_Dummy          0.37185083  0.2222322 9.442877e-02
## TV_Dummy            0.86060861  0.4610868 6.211609e-02
## SELFEMPLOYED       -0.22007692  0.2502389 3.792503e-01
## TIME_EMPLOYED      -0.04064783  0.2192742 8.529536e-01

```

```
data.frame(summary(lm8)$coefficients[1:13, c(1,2,4)])
```

	Estimate	Std..Error	Pr...t..
## Improves_Health	0.19775616	0.3796093	0.602459619
## Time_Money	0.79383722	0.3710207	0.032503169
## Time_Money_Health	-0.11035662	0.3686152	0.764678879
## HH_PHONES	0.39750439	0.2025065	0.049788744
## INCOME_Dummy	1.39411131	0.5124775	0.006575952
## BICYCLE_DUMMY	0.42523458	0.2771297	0.125077737
## CAR_DUMMY	0.79285216	1.0843020	0.464733629
## MOTORCYCLE_DUMMY	1.26874289	0.4423003	0.004165785
## RADIO_DUMMY	0.40628378	0.4339979	0.349308834
## COWS_Dummy	0.34670228	0.3062800	0.257774348
## TV_Dummy	1.34569007	0.6350659	0.034210896
## SELFEMPLOYED	-0.42449053	0.3422070	0.214949380
## TIME_EMPLOYED	-0.01290819	0.3013745	0.965840311

Use the total asset

```
lm9 = lm(MAXBID ~ Improves_Health + Time_Money + Time_Money_Health+ ASSET_TOTAL+ DATESURVEY+PARISH-1,na.omit)
summary(lm9)
```

```

##
## Call:
## lm(formula = MAXBID ~ Improves_Health + Time_Money + Time_Money_Health +
##     ASSET_TOTAL + DATESURVEY + PARISH - 1, data = data_plus,
##     na.action = na.omit)
##
## Residuals:
##    Min      1Q  Median      3Q     Max 
## -9.233 -2.254 -0.782  1.133 75.033 
##
## Coefficients: (17 not defined because of singularities)
##                  Estimate Std. Error t value Pr(>|t|)    
## Improves_Health      9.679e-01  2.627e-01   3.684 0.000236 ***  
## Time_Money           8.384e-02  2.651e-01   0.316 0.751877    
## Time_Money_Health    3.295e-01  2.608e-01   1.263 0.206652    
## ASSET_TOTAL          5.333e-04  8.629e-05   6.181 7.67e-10 ***  

```

## DATESURVEY01-Feb-12	4.464e+00	6.175e-01	7.229	6.83e-13	***
## DATESURVEY01-Mar-12	3.219e+00	5.559e-01	5.791	8.08e-09	***
## DATESURVEY02-Feb-12	3.401e+00	6.274e-01	5.421	6.62e-08	***
## DATESURVEY03-Feb-12	5.092e+00	6.228e-01	8.176	5.04e-16	***
## DATESURVEY06-Feb-12	7.172e+00	6.730e-01	10.657	< 2e-16	***
## DATESURVEY07-Feb-12	3.690e+00	5.544e-01	6.656	3.59e-11	***
## DATESURVEY08-Feb-12	8.656e+00	5.944e-01	14.561	< 2e-16	***
## DATESURVEY09-Feb-12	6.757e+00	7.058e-01	9.573	< 2e-16	***
## DATESURVEY10-Feb-12	6.801e+00	6.649e-01	10.230	< 2e-16	***
## DATESURVEY14-Feb-12	3.802e+00	1.249e+00	3.044	0.002362	**
## DATESURVEY15-Feb-12	2.623e+00	5.928e-01	4.424	1.02e-05	***
## DATESURVEY16-Feb-12	1.801e+00	2.165e+00	0.832	0.405524	
## DATESURVEY17-Feb-12	3.584e+00	4.293e+00	0.835	0.403953	
## DATESURVEY21-Feb-12	3.071e+00	4.294e+00	0.715	0.474469	
## DATESURVEY22-Feb-12	1.953e+00	5.247e-01	3.722	0.000203	***
## DATESURVEY23-Feb-12	1.961e+00	6.030e-01	3.253	0.001162	**
## DATESURVEY24-Feb-12	3.619e+00	5.929e-01	6.105	1.23e-09	***
## DATESURVEY27-Feb-12	1.475e+00	4.294e+00	0.343	0.731269	
## DATESURVEY28-Feb-12	4.633e+00	5.358e-01	8.647	< 2e-16	***
## DATESURVEY29-Feb-12	4.441e+00	5.533e-01	8.027	1.66e-15	***
## DATESURVEY31-Jan-12	2.415e+00	5.763e-01	4.191	2.90e-05	***
## PARISHBukiro	4.968e+00	2.228e+00	2.229	0.025895	*
## PARISHBwengure	2.816e+00	4.320e+00	0.652	0.514487	
## PARISHKabarama	3.911e+00	7.829e-01	4.995	6.38e-07	***
## PARISHKakigaani	-3.440e+00	9.080e-01	-3.789	0.000156	***
## PARISHKamomo	-2.153e+00	7.946e-01	-2.710	0.006783	**
## PARISHKibingo_Bugamba	NA	NA	NA	NA	
## PARISHKibingo_Kagogi	NA	NA	NA	NA	
## PARISHKigaaga	2.076e+00	8.024e-01	2.587	0.009736	**
## PARISHKitojo	NA	NA	NA	NA	
## PARISHKitunguru	1.050e+00	1.411e+00	0.744	0.456918	
## PARISHKongoro	4.283e-01	7.408e-01	0.578	0.563238	
## PARISHKyandah	-1.490e+00	4.320e+00	-0.345	0.730256	
## PARISHMirama	-4.491e-01	8.657e-01	-0.519	0.603988	
## PARISHMirongo	1.010e+00	7.481e-01	1.350	0.177116	
## PARISHMitoozo	2.085e+00	8.080e-01	2.580	0.009944	**
## PARISHNcune	NA	NA	NA	NA	
## PARISHNdeija	NA	NA	NA	NA	
## PARISHNgango	2.064e+00	7.482e-01	2.759	0.005849	**
## PARISHNgoma	-2.198e+00	7.303e-01	-3.010	0.002642	**
## PARISHNgugo	-5.808e-01	7.435e-01	-0.781	0.434776	
## PARISHNsinka	NA	NA	NA	NA	
## PARISHNtuura	-1.114e+00	4.319e+00	-0.258	0.796505	
## PARISHNyabikungu	NA	NA	NA	NA	
## PARISHNyabisirira	NA	NA	NA	NA	
## PARISHNyaihang	NA	NA	NA	NA	
## PARISHNyakabare	3.065e+00	9.382e-01	3.267	0.001105	**
## PARISHNyakaikara	-4.627e+00	8.064e-01	-5.737	1.10e-08	***
## PARISHNyanja	7.435e-01	2.206e+00	0.337	0.736097	
## PARISHNyarubungo_Bwizibwera	7.276e-01	4.325e+00	0.168	0.866416	
## PARISHNyarubungo_Ndija	NA	NA	NA	NA	
## PARISHNyaruhandagazi	NA	NA	NA	NA	
## PARISHOther	NA	NA	NA	NA	
## PARISHRubingo	NA	NA	NA	NA	

```

## PARISHRukarabo NA NA NA NA
## PARISHRweibogo NA NA NA NA
## PARISHRwensinga NA NA NA NA
## PARISHRyamiyonga NA NA NA NA
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.285 on 2074 degrees of freedom
## (109 observations deleted due to missingness)
## Multiple R-squared: 0.6031, Adjusted R-squared: 0.5945
## F-statistic: 70.03 on 45 and 2074 DF, p-value: < 2.2e-16

```

```

lm10 = lm(MAXBIDNOVEL ~ Improves_Health + Time_Money + Time_Money_Health+ASSET_TOTAL+ DATESURVEY+PARISH-
summary(lm10)

```

```

##
## Call:
## lm(formula = MAXBIDNOVEL ~ Improves_Health + Time_Money + Time_Money_Health +
##     ASSET_TOTAL + DATESURVEY + PARISH - 1, data = data_plus,
##     na.action = na.omit)
##
## Residuals:
##      Min        1Q    Median        3Q        Max
## -12.822   -2.882   -1.191    1.422   74.767
##
## Coefficients: (17 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)
## Improves_Health          0.0024081  0.3651410  0.007 0.994739
## Time_Money                0.6055864  0.3623862  1.671 0.094851 .
## Time_Money_Health         -0.1424853  0.3603553 -0.395 0.692587
## ASSET_TOTAL                 0.0006298  0.0001196  5.267 1.53e-07 ***
## DATESURVEY01-Feb-12       4.7253017  0.8602629  5.493 4.44e-08 ***
## DATESURVEY01-Mar-12       4.8986774  0.7627074  6.423 1.65e-10 ***
## DATESURVEY02-Feb-12       5.1292132  0.8664440  5.920 3.76e-09 ***
## DATESURVEY03-Feb-12       7.3613013  0.8600079  8.560 < 2e-16 ***
## DATESURVEY06-Feb-12       9.6123848  0.9394088 10.232 < 2e-16 ***
## DATESURVEY07-Feb-12       5.9896237  0.7714762  7.764 1.28e-14 ***
## DATESURVEY08-Feb-12       12.4824706 0.8222511 15.181 < 2e-16 ***
## DATESURVEY09-Feb-12       9.2374227  0.9634378  9.588 < 2e-16 ***
## DATESURVEY10-Feb-12       10.1147888 0.8998969 11.240 < 2e-16 ***
## DATESURVEY14-Feb-12       4.9865584  1.7247294  2.891 0.003877 **
## DATESURVEY15-Feb-12       4.3472749  0.8062337  5.392 7.75e-08 ***
## DATESURVEY16-Feb-12       7.2811962  2.9900232  2.435 0.014968 *
## DATESURVEY17-Feb-12       4.0444435  5.9289467  0.682 0.495219
## DATESURVEY21-Feb-12       3.3402693  5.9290832  0.563 0.573243
## DATESURVEY22-Feb-12       2.8907265  0.7246094  3.989 6.85e-05 ***
## DATESURVEY23-Feb-12       3.7408549  0.8597101  4.351 1.42e-05 ***
## DATESURVEY24-Feb-12       6.1307550  0.8112888  7.557 6.15e-14 ***
## DATESURVEY27-Feb-12       0.8756296  5.9301486  0.148 0.882628
## DATESURVEY28-Feb-12       7.7048589  0.7355003 10.476 < 2e-16 ***
## DATESURVEY29-Feb-12       6.6523759  0.7447018  8.933 < 2e-16 ***
## DATESURVEY31-Jan-12       3.5549005  0.7958448  4.467 8.36e-06 ***
## PARISHBukiro             3.0466213  3.0736829  0.991 0.321705
## PARISHBwengure            6.0263188  5.9645013  1.010 0.312438

```

```

## PARISHKabarama      5.1613919  1.0813576  4.773 1.94e-06 ***
## PARISHKakigaani    -3.8530643  1.2397036 -3.108 0.001909 **
## PARISHKamomo        -1.1385999  1.1033942 -1.032 0.302236
## PARISHKibingo_Bugamba   NA          NA          NA          NA
## PARISHKibingo_Kagogi   NA          NA          NA          NA
## PARISHKigaaga       1.8217728  1.0877587  1.675 0.094125 .
## PARISHKitojo         NA          NA          NA          NA
## PARISHKitunguru     2.0317344  1.9374269  1.049 0.294449
## PARISHKongoro       -0.3692633  1.0308697 -0.358 0.720226
## PARISHKyandahi      -0.7949181  5.9677999 -0.133 0.894047
## PARISHMirama        -1.1969306  1.1762817 -1.018 0.309008
## PARISHMirongo       1.3337276  1.0276593  1.298 0.194489
## PARISHMitoozo       1.9547290  1.1367059  1.720 0.085646 .
## PARISHNcune          NA          NA          NA          NA
## PARISHNdeija         NA          NA          NA          NA
## PARISHNgango         3.6836259  1.0238550  3.598 0.000328 ***
## PARISHNgoma          -3.9839844  1.0012604 -3.979 7.16e-05 ***
## PARISHNgugo          -0.6883381  1.0438959 -0.659 0.509716
## PARISHNsinka         NA          NA          NA          NA
## PARISHNtuura         0.2095978  5.9649381  0.035 0.971973
## PARISHNyabikungu    NA          NA          NA          NA
## PARISHNyabisirira   NA          NA          NA          NA
## PARISHNyaihangha    NA          NA          NA          NA
## PARISHNyakabare      3.1066904  1.2874745  2.413 0.015907 *
## PARISHNyakaikara    -5.3491348  1.1185386 -4.782 1.85e-06 ***
## PARISHNyanya          -2.2522386  3.0457677 -0.739 0.459708
## PARISHNyarubungo_Bwizibwera 2.6001719  5.9695147  0.436 0.663190
## PARISHNyarubungo_Ndiija  NA          NA          NA          NA
## PARISHNyaruhandagazi NA          NA          NA          NA
## PARISHOther           NA          NA          NA          NA
## PARISHRubingo         NA          NA          NA          NA
## PARISHRukarabo        NA          NA          NA          NA
## PARISHRweibogo        NA          NA          NA          NA
## PARISHRwensinga       NA          NA          NA          NA
## PARISHRyamiyonga     NA          NA          NA          NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.918 on 2084 degrees of freedom
##   (99 observations deleted due to missingness)
## Multiple R-squared:  0.6079, Adjusted R-squared:  0.5994
## F-statistic: 71.78 on 45 and 2084 DF,  p-value: < 2.2e-16

```

## 5.4 Multiple regression + Cookstove level controls+ Total Asset [District FE + Survey Date FE ]

```

lm11 = lm(MAXBID ~ Improves_Health + Time_Money + Time_Money_Health+WOOD+TSF_PRIMARY+BUYWOOD_DUMMY+ GATI
summary(lm11)

```

```

## 
## Call:
## lm(formula = MAXBID ~ Improves_Health + Time_Money + Time_Money_Health +
## 
```

```

##      WOOD + TSF_PRIMARY + BUYWOOD_DUMMY + GATHERWOOD_DUMMY + STOVES1 +
##      DATESURVEY + PARISH + ASSET_TOTAL - 1, data = data_plus,
##      na.action = na.omit)
##
## Residuals:
##      Min     1Q Median     3Q    Max
## -9.087 -2.252 -0.738  1.122 75.168
##
## Coefficients: (18 not defined because of singularities)
##                               Estimate Std. Error t value Pr(>|t|)
## Improves_Health           1.007e+00 2.642e-01  3.810 0.000143 ***
## Time_Money                 1.077e-01 2.678e-01  0.402 0.687545
## Time_Money_Health          3.421e-01 2.634e-01  1.299 0.194244
## WOOD                      -1.014e-01 6.460e-01 -0.157 0.875271
## TSF_PRIMARY                4.387e+00 8.844e-01  4.960 7.62e-07 ***
## BUYWOOD_DUMMY              2.319e-01 2.286e-01  1.014 0.310531
## GATHERWOOD_DUMMY           4.439e-02 3.339e-01  0.133 0.894249
## STOVES1Built-in Mud Stove  4.856e+00 9.214e-01  5.270 1.51e-07 ***
## STOVES1Charcoal Stove      4.605e+00 8.801e-01  5.232 1.84e-07 ***
## STOVES1None                  NA        NA       NA       NA
## STOVES1Other                 4.706e+00 9.704e-01  4.849 1.33e-06 ***
## DATESURVEY01-Mar-12        -1.242e+00 8.005e-01 -1.551 0.121059
## DATESURVEY02-Feb-12        -1.072e+00 8.439e-01 -1.270 0.204081
## DATESURVEY03-Feb-12        5.778e-01 8.460e-01  0.683 0.494673
## DATESURVEY06-Feb-12        2.648e+00 8.854e-01  2.990 0.002822 **
## DATESURVEY07-Feb-12        -8.454e-01 7.990e-01 -1.058 0.290157
## DATESURVEY08-Feb-12        4.141e+00 8.283e-01  5.000 6.22e-07 ***
## DATESURVEY09-Feb-12        2.215e+00 9.099e-01  2.435 0.014995 *
## DATESURVEY10-Feb-12        2.291e+00 8.806e-01  2.601 0.009349 **
## DATESURVEY14-Feb-12        -7.554e-01 1.376e+00 -0.549 0.583049
## DATESURVEY15-Feb-12        -1.878e+00 8.262e-01 -2.273 0.023118 *
## DATESURVEY16-Feb-12        -2.817e+00 2.241e+00 -1.257 0.208932
## DATESURVEY17-Feb-12        -7.562e-01 4.332e+00 -0.175 0.861460
## DATESURVEY21-Feb-12        -1.600e+00 4.361e+00 -0.367 0.713641
## DATESURVEY22-Feb-12        -2.502e+00 7.768e-01 -3.221 0.001299 **
## DATESURVEY23-Feb-12        -2.484e+00 8.250e-01 -3.011 0.002633 **
## DATESURVEY24-Feb-12        -8.742e-01 8.208e-01 -1.065 0.286955
## DATESURVEY27-Feb-12        -2.863e+00 4.332e+00 -0.661 0.508775
## DATESURVEY28-Feb-12        1.860e-01 7.840e-01  0.237 0.812543
## DATESURVEY29-Feb-12        -1.450e-02 8.002e-01 -0.018 0.985541
## DATESURVEY31-Jan-12        -2.162e+00 8.199e-01 -2.638 0.008411 **
## PARISHBukiro                 5.030e+00 2.234e+00  2.252 0.024434 *
## PARISHBwengure               3.038e+00 4.350e+00  0.699 0.484934
## PARISHKabarama               3.849e+00 7.841e-01  4.908 9.90e-07 ***
## PARISHKakigaani              -3.398e+00 9.097e-01 -3.736 0.000192 ***
## PARISHKamomo                 -2.167e+00 7.970e-01 -2.719 0.006602 **
## PARISHKibingo_Bugamba            NA        NA       NA       NA
## PARISHKibingo_Kagogi            NA        NA       NA       NA
## PARISHKigaaga                 2.020e+00 8.045e-01  2.510 0.012138 *
## PARISHKitojo                  NA        NA       NA       NA
## PARISHKitunguru                1.110e+00 1.414e+00  0.785 0.432408
## PARISHKongoro                  4.278e-01 7.490e-01  0.571 0.567978
## PARISHKyandahи                -1.234e+00 4.353e+00 -0.283 0.776825
## PARISHMirama                  -4.767e-01 8.683e-01 -0.549 0.583053

```

```

## PARISHMirongo          9.942e-01  7.486e-01  1.328 0.184326
## PARISHMitoozo          2.076e+00  8.086e-01  2.567 0.010329 *
## PARISHNcune             NA          NA          NA          NA
## PARISHNdeija            NA          NA          NA          NA
## PARISHNgango             2.020e+00  7.498e-01  2.694 0.007127 **
## PARISHNgoma              -2.185e+00 7.315e-01 -2.987 0.002854 **
## PARISHNgugo              -5.392e-01 7.584e-01 -0.711 0.477205
## PARISHNsinka             NA          NA          NA          NA
## PARISHNtuura             -1.222e+00 4.322e+00 -0.283 0.777381
## PARISHNyabikungu        NA          NA          NA          NA
## PARISHNyabisirira       NA          NA          NA          NA
## PARISHNyaihang           NA          NA          NA          NA
## PARISHNyakabare          3.037e+00  9.401e-01  3.230 0.001256 **
## PARISHNyakaikara         -4.637e+00 8.109e-01 -5.718 1.24e-08 ***
## PARISHNyanja              8.489e-01  2.210e+00  0.384 0.700954
## PARISHNyarubungo_Bwizibwera 5.031e-01  4.329e+00  0.116 0.907479
## PARISHNyarubungo_Ndija   NA          NA          NA          NA
## PARISHNyaruhandagazi    NA          NA          NA          NA
## PARISHOther               NA          NA          NA          NA
## PARISHRubingo             NA          NA          NA          NA
## PARISHRukarabo            NA          NA          NA          NA
## PARISHRweibogo            NA          NA          NA          NA
## PARISHRwensinga           NA          NA          NA          NA
## PARISHRyamiyonga          NA          NA          NA          NA
## ASSET_TOTAL                5.138e-04  8.818e-05  5.827 6.54e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.287 on 2068 degrees of freedom
##   (109 observations deleted due to missingness)
## Multiple R-squared:  0.6039, Adjusted R-squared:  0.5941
## F-statistic: 61.82 on 51 and 2068 DF,  p-value: < 2.2e-16

```

```

lm12 = lm(MAXBIDNOVEL ~ Improves_Health + Time_Money + Time_Money_Health+WOOD+TSF_PRIMARY+BUYWOOD_DUMMY+
summary(lm12)

```

```

##
## Call:
## lm(formula = MAXBIDNOVEL ~ Improves_Health + Time_Money + Time_Money_Health +
##     WOOD + TSF_PRIMARY + BUYWOOD_DUMMY + GATHERWOOD_DUMMY + STOVES1 +
##     DATESURVEY + PARISH + ASSET_TOTAL - 1, data = data_plus,
##     na.action = na.omit)
##
## Residuals:
##      Min      1Q Median      3Q      Max 
## -12.542 -2.867 -1.188  1.441  74.971 
##
## Coefficients: (18 not defined because of singularities)
##                               Estimate Std. Error t value Pr(>|t|)    
## Improves_Health            0.0508171  0.3668709  0.139 0.889847  
## Time_Money                  0.6163732  0.3657777  1.685 0.092119 .  
## Time_Money_Health           -0.1570588  0.3638146 -0.432 0.666004  
## WOOD                         0.1701905  0.8856708  0.192 0.847636  
## TSF_PRIMARY                 4.3245738  1.2206340  3.543 0.000404 *** 
## 
```

## BUYWOOD_DUMMY	0.5522683	0.3141439	1.758	0.078893	.
## GATHERWOOD_DUMMY	0.0275646	0.4610037	0.060	0.952327	
## STOVES1Built-in Mud Stove	4.8394039	1.2717185	3.805	0.000146	***
## STOVES1Charcoal Stove	4.7534191	1.2131015	3.918	9.20e-05	***
## STOVES1None	NA	NA	NA	NA	
## STOVES1Other	4.3825333	1.3409756	3.268	0.001100	**
## DATESURVEY01-Mar-12	0.1268004	1.1071483	0.115	0.908830	
## DATESURVEY02-Feb-12	0.3636330	1.1703228	0.311	0.756051	
## DATESURVEY03-Feb-12	2.5611418	1.1733523	2.183	0.029165	*
## DATESURVEY06-Feb-12	4.7524865	1.2354765	3.847	0.000123	***
## DATESURVEY07-Feb-12	1.0662938	1.1128487	0.958	0.338091	
## DATESURVEY08-Feb-12	7.6792200	1.1489278	6.684	2.98e-11	***
## DATESURVEY09-Feb-12	4.3573450	1.2520026	3.480	0.000511	***
## DATESURVEY10-Feb-12	5.3187583	1.2065407	4.408	1.10e-05	***
## DATESURVEY14-Feb-12	0.1584618	1.9026480	0.083	0.933633	
## DATESURVEY15-Feb-12	-0.4712398	1.1366097	-0.415	0.678477	
## DATESURVEY16-Feb-12	2.4550890	3.0953090	0.793	0.427773	
## DATESURVEY17-Feb-12	-0.4618948	5.9808872	-0.077	0.938449	
## DATESURVEY21-Feb-12	-1.2502273	6.0201249	-0.208	0.835503	
## DATESURVEY22-Feb-12	-1.8028763	1.0783404	-1.672	0.094695	.
## DATESURVEY23-Feb-12	-0.9638404	1.1648510	-0.827	0.408085	
## DATESURVEY24-Feb-12	1.3615227	1.1340742	1.201	0.230059	
## DATESURVEY27-Feb-12	-3.6478046	5.9800884	-0.610	0.541934	
## DATESURVEY28-Feb-12	2.9643087	1.0851845	2.732	0.006356	**
## DATESURVEY29-Feb-12	1.9080256	1.0960245	1.741	0.081856	.
## DATESURVEY31-Jan-12	-1.3654495	1.1371520	-1.201	0.229980	
## PARISHBukiro	2.9284183	3.0797922	0.951	0.341791	
## PARISHBwengure	5.9102036	6.0033062	0.984	0.324989	
## PARISHKabarama	5.0626787	1.0820946	4.679	3.07e-06	***
## PARISHKakigaani	-3.7809933	1.2413241	-3.046	0.002349	**
## PARISHKamomo	-1.2005037	1.1060010	-1.085	0.277850	
## PARISHKibingo_Bugamba	NA	NA	NA	NA	
## PARISHKibingo_Kagogi	NA	NA	NA	NA	
## PARISHKigaaga	1.7326744	1.0901046	1.589	0.112109	
## PARISHKitojo	NA	NA	NA	NA	
## PARISHKitunguru	2.0498333	1.9410248	1.056	0.291065	
## PARISHKongoro	-0.2740747	1.0407795	-0.263	0.792318	
## PARISHKyandahi	-0.8958175	6.0103712	-0.149	0.881532	
## PARISHMirama	-1.2891184	1.1790898	-1.093	0.274382	
## PARISHMirongo	1.3056677	1.0277874	1.270	0.204096	
## PARISHMitoozo	1.9382937	1.1371850	1.704	0.088443	.
## PARISHNcune	NA	NA	NA	NA	
## PARISHNdeija	NA	NA	NA	NA	
## PARISHNgango	3.5837006	1.0256161	3.494	0.000485	***
## PARISHNgoma	-3.9637623	1.0023280	-3.955	7.92e-05	***
## PARISHNgugo	-0.6073157	1.0634415	-0.571	0.568004	
## PARISHNsinka	NA	NA	NA	NA	
## PARISHNtuura	-0.0269341	5.9654229	-0.005	0.996398	
## PARISHNyabikungu	NA	NA	NA	NA	
## PARISHNyabisirira	NA	NA	NA	NA	
## PARISHNyaihangha	NA	NA	NA	NA	
## PARISHNyakabare	3.1035986	1.2893749	2.407	0.016168	*
## PARISHNyakaikara	-5.3518274	1.1244932	-4.759	2.08e-06	***
## PARISHNyanja	-2.2381869	3.0504907	-0.734	0.463206	

```

## PARISHNyarubungo_Bwizibwera  2.1697226  5.9717079  0.363 0.716393
## PARISHNyarubungo_Ndija        NA          NA          NA          NA
## PARISHNyaruhandagazi         NA          NA          NA          NA
## PARISHOther                   NA          NA          NA          NA
## PARISHRubingo                 NA          NA          NA          NA
## PARISHRukarabo                NA          NA          NA          NA
## PARISHRweibogo                NA          NA          NA          NA
## PARISHRwensinga               NA          NA          NA          NA
## PARISHRyamiyonga              NA          NA          NA          NA
## ASSET_TOTAL                  0.0006178  0.0001222  5.056 4.65e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.917 on 2078 degrees of freedom
##   (99 observations deleted due to missingness)
## Multiple R-squared:  0.6091, Adjusted R-squared:  0.5995
## F-statistic: 63.48 on 51 and 2078 DF,  p-value: < 2.2e-16

```

```
data.frame(summary(lm11)$coefficients[1:10, c(1,2,4)])
```

	Estimate	Std..Error	Pr....t..
## Improves_Health	1.00668778	0.2642000	1.428375e-04
## Time_Money	0.10771654	0.2677882	6.875450e-01
## Time_Money_Health	0.34206791	0.2634237	1.942444e-01
## WOOD	-0.10141849	0.6460343	8.752710e-01
## TSF_PRIMARY	4.38676703	0.8843941	7.616784e-07
## BUYWOOD_DUMMY	0.23186273	0.2285808	3.105308e-01
## GATHERWOOD_DUMMY	0.04438889	0.3338859	8.942488e-01
## STOVES1Built-in Mud Stove	4.85589534	0.9214467	1.507333e-07
## STOVES1Charcoal Stove	4.60515183	0.8801366	1.843226e-07
## STOVES10ther	4.70597637	0.9704318	1.330937e-06

```
data.frame(summary(lm12)$coefficients[1:10, c(1,2,4)])
```

	Estimate	Std..Error	Pr....t..
## Improves_Health	0.05081708	0.3668709	8.898469e-01
## Time_Money	0.61637318	0.3657777	9.211883e-02
## Time_Money_Health	-0.15705883	0.3638146	6.660042e-01
## WOOD	0.17019048	0.8856708	8.476357e-01
## TSF_PRIMARY	4.32457376	1.2206340	4.044955e-04
## BUYWOOD_DUMMY	0.55226831	0.3141439	7.889296e-02
## GATHERWOOD_DUMMY	0.02756460	0.4610037	9.523266e-01
## STOVES1Built-in Mud Stove	4.83940391	1.2717185	1.456665e-04
## STOVES1Charcoal Stove	4.75341912	1.2131015	9.202052e-05
## STOVES10ther	4.38253331	1.3409756	1.100112e-03

## 5.5 Multiple regression + Socio-economic demographic + Wealth + Cookstove related characteristics [District FE + Survey Date FE]

```

lmfull = lm(MAXBID ~ Improves_Health + Time_Money + Time_Money_Health+FEMALE + AGE + MARRIED + KNOWLUNCH_Dummy
summary(lmfull)

## 
## Call:
## lm(formula = MAXBID ~ Improves_Health + Time_Money + Time_Money_Health +
##     FEMALE + AGE + MARRIED + KNOWLUNCH_Dummy + WIFECOOK + JOINTDECISION +
##     WOOD + TSF_PRIMARY + BUYWOOD_DUMMY + GATHERWOOD_DUMMY + STOVES1 +
##     DATESURVEY + PARISH + ASSET_TOTAL - 1, data = data_plus,
##     na.action = na.omit)
## 
## Residuals:
##    Min      1Q Median      3Q     Max 
## -9.625 -2.227 -0.747  1.150 74.092 
## 
## Coefficients: (18 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)    
## Improves_Health          0.9821990  0.2644275  3.714 0.000209 ***  
## Time_Money                 0.3219807  0.2743956  1.173 0.240764    
## Time_Money_Health          0.3729143  0.2626205  1.420 0.155766    
## FEMALE                   -1.2616387  0.2393736 -5.271 1.50e-07 ***  
## AGE                      -0.0140284  0.0072077 -1.946 0.051753 .    
## MARRIED                  0.2815532  0.2774773  1.015 0.310373    
## KNOWLUNCH_Dummy           0.8289513  0.3456312  2.398 0.016557 *   
## WIFECOOK                 -0.1398223  0.3159161 -0.443 0.658106    
## JOINTDECISION             0.0379866  0.2147801  0.177 0.859634    
## WOOD                     -0.0381286  0.6425576 -0.059 0.952688    
## TSF_PRIMARY                4.8974078  1.0007243  4.894 1.07e-06 ***  
## BUYWOOD_DUMMY              0.1963850  0.2276832  0.863 0.388493    
## GATHERWOOD_DUMMY           0.0438775  0.3320866  0.132 0.894897    
## STOVES1Built-in Mud Stove  5.5247484  1.0394436  5.315 1.18e-07 ***  
## STOVES1Charcoal Stove       5.0137298  0.9879257  5.075 4.22e-07 ***  
## STOVES1None                  NA        NA        NA        NA      
## STOVES1Other                 5.1993726  1.0634172  4.889 1.09e-06 ***  
## DATESURVEY01-Mar-12        -1.4714884  0.7976996 -1.845 0.065230 .    
## DATESURVEY02-Feb-12        -1.5642411  0.8421233 -1.857 0.063383 .    
## DATESURVEY03-Feb-12        0.1135674  0.8450068  0.134 0.893101    
## DATESURVEY06-Feb-12        2.5730115  0.8793699  2.926 0.003471 **  
## DATESURVEY07-Feb-12        -0.7298771  0.7931105 -0.920 0.357538    
## DATESURVEY08-Feb-12        4.0195816  0.8230225  4.884 1.12e-06 ***  
## DATESURVEY09-Feb-12        2.3419742  0.9039437  2.591 0.009642 **  
## DATESURVEY10-Feb-12        2.5470922  0.8750894  2.911 0.003645 **  
## DATESURVEY14-Feb-12        -0.8093853  1.3669118 -0.592 0.553830    
## DATESURVEY15-Feb-12        -1.9732936  0.8251745 -2.391 0.016875 *   
## DATESURVEY16-Feb-12        -2.8959645  2.2272842 -1.300 0.193670    
## DATESURVEY17-Feb-12        0.2843561  4.3140037  0.066 0.947452    
## DATESURVEY21-Feb-12        -0.9090336  4.3447982 -0.209 0.834294    
## DATESURVEY22-Feb-12        -2.1969893  0.7728852 -2.843 0.004519 **  
## DATESURVEY23-Feb-12        -2.7193291  0.8195863 -3.318 0.000923 ***  
## DATESURVEY24-Feb-12        -0.9088112  0.8153703 -1.115 0.265152    
## DATESURVEY27-Feb-12        -1.5633343  4.3181051 -0.362 0.717358    
## DATESURVEY28-Feb-12        0.1482522  0.7784354  0.190 0.848976    
## DATESURVEY29-Feb-12        -0.1972756  0.7972806 -0.247 0.804596

```

```

## DATESURVEY31-Jan-12      -2.2357392  0.8146970  -2.744 0.006117 **
## PARISHBukiro              5.1435483  2.2189534  2.318 0.020546 *
## PARISHBwengure            2.4219918  4.3314868  0.559 0.576114
## PARISHKabarama            4.0544510  0.7811553  5.190 2.31e-07 ***
## PARISHKakigaani           -3.3970920  0.9040099  -3.758 0.000176 ***
## PARISHKamomo               -2.4744081  0.7952194  -3.112 0.001886 **
## PARISHKibingo_Bugamba     NA          NA          NA          NA
## PARISHKibingo_Kagogi      NA          NA          NA          NA
## PARISHKigaaga             2.3199081  0.8036129  2.887 0.003932 **
## PARISHKitojo               NA          NA          NA          NA
## PARISHKitunguru           1.3155179  1.4054309  0.936 0.349370
## PARISHKongoro              0.2044082  0.7461751  0.274 0.784157
## PARISHKyandahi             -1.7253550  4.3400823  -0.398 0.691011
## PARISHMirama               -0.4981032  0.8621574  -0.578 0.563502
## PARISHMirongo              1.0647145  0.7458153  1.428 0.153563
## PARISHMitoozo              2.2622897  0.8068414  2.804 0.005096 **
## PARISHNcune                NA          NA          NA          NA
## PARISHNdeija               NA          NA          NA          NA
## PARISHNgango               1.9453636  0.7445363  2.613 0.009044 **
## PARISHNgoma                -2.0905014  0.7270061  -2.875 0.004075 **
## PARISHNgugo                -0.6717553  0.7541591  -0.891 0.373176
## PARISHNsinka               NA          NA          NA          NA
## PARISHNtuura               -2.1867380  4.3005112  -0.508 0.611169
## PARISHNyabikungu           NA          NA          NA          NA
## PARISHNyabisirira          NA          NA          NA          NA
## PARISHNyaihangaa           NA          NA          NA          NA
## PARISHNyakabare             3.3129220  0.9374966  3.534 0.000419 ***
## PARISHNyakaikara            -4.4332491  0.8072252  -5.492 4.47e-08 ***
## PARISHNyanya                0.7989042  2.1968460  0.364 0.716149
## PARISHNyarubungo_Bwizibwera -0.5870769  4.3106976  -0.136 0.891684
## PARISHNyarubungo_Ndiija    NA          NA          NA          NA
## PARISHNyaruhandagazi       NA          NA          NA          NA
## PARISHOther                 NA          NA          NA          NA
## PARISHRubingo               NA          NA          NA          NA
## PARISHRukarabo              NA          NA          NA          NA
## PARISHRweibogo              NA          NA          NA          NA
## PARISHRwensinga             NA          NA          NA          NA
## PARISHRyamiyonga            NA          NA          NA          NA
## ASSET_TOTAL                 0.0004990  0.0000884  5.644 1.89e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.254 on 2062 degrees of freedom
##   (109 observations deleted due to missingness)
## Multiple R-squared:  0.6112, Adjusted R-squared:  0.6004
## F-statistic: 56.87 on 57 and 2062 DF,  p-value: < 2.2e-16

```

The R square here reported is 60.04%.

## 5.6 Multiple regression + Gender and interaction terms [District FE + Survey Date FE]

Female\_WOOD and Female\_LUNCHYESTERDAY are ignore since they are higly insignificant.

```
lm13 = lm(MAXBID ~ Improves_Health + Time_Money + Time_Money_Health+FEMALE + WIFECOOK+ Female_AGE+ Fem
summary(lm13)
```

```
## 
## Call:
## lm(formula = MAXBID ~ Improves_Health + Time_Money + Time_Money_Health +
##      FEMALE + WIFECOOK + Female_AGE + Female_MARRIED + Female_WIFECOOK +
##      Female_JOINTDECISION + Female_KNOLUNCH_Dummy + Female_INCOME_Dummy +
##      Female_TSF_PRIMARY + Female_BUYWOOD_DUMMY + Female_GATHERWOOD_DUMMY +
##      DATESURVEY + PARISH + ASSET_TOTAL - 1, data = data_plus,
##      na.action = na.omit)
## 
## Residuals:
##    Min      1Q Median      3Q     Max 
## -9.897 -2.209 -0.736  1.088 74.278 
## 
## Coefficients: (17 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)    
## Improves_Health       1.084e+00  2.688e-01   4.035 5.66e-05 ***
## Time_Money            1.812e-01  2.684e-01   0.675 0.499733  
## Time_Money_Health     3.174e-01  2.619e-01   1.212 0.225716  
## FEMALE                -2.765e+00 9.478e-01  -2.917 0.003567 ** 
## WIFECOOK              -4.322e-01  4.066e-01  -1.063 0.287923  
## Female_AGE             -8.709e-03  9.163e-03  -0.950 0.341986  
## Female_MARRIED         3.165e-01  3.093e-01   1.023 0.306236  
## Female_WIFECOOK        6.082e-01  6.128e-01   0.992 0.321090  
## Female_JOINTDECISION   1.602e-02  2.581e-01   0.062 0.950518  
## Female_KNOLUNCH_Dummy  5.014e-01  5.502e-01   0.911 0.362208  
## Female_INCOME_Dummy    5.840e-01  3.286e-01   1.777 0.075655 .  
## Female_TSF_PRIMARY     -2.145e-01  2.620e-01  -0.819 0.413064  
## Female_BUYWOOD_DUMMY   4.893e-01  2.686e-01   1.821 0.068692 .  
## Female_GATHERWOOD_DUMMY 3.409e-01  3.925e-01   0.868 0.385274  
## DATESURVEY01-Feb-12    5.653e+00  6.983e-01   8.095 9.69e-16 ***
## DATESURVEY01-Mar-12    4.119e+00  6.668e-01   6.177 7.83e-10 *** 
## DATESURVEY02-Feb-12    4.142e+00  6.975e-01   5.938 3.38e-09 *** 
## DATESURVEY03-Feb-12    5.819e+00  6.996e-01   8.317 < 2e-16 *** 
## DATESURVEY06-Feb-12    8.173e+00  7.479e-01  10.928 < 2e-16 *** 
## DATESURVEY07-Feb-12    4.790e+00  6.506e-01   7.363 2.59e-13 *** 
## DATESURVEY08-Feb-12    9.635e+00  6.765e-01  14.242 < 2e-16 *** 
## DATESURVEY09-Feb-12    7.945e+00  7.892e-01  10.068 < 2e-16 *** 
## DATESURVEY10-Feb-12    8.089e+00  7.501e-01  10.784 < 2e-16 *** 
## DATESURVEY14-Feb-12    4.795e+00  1.296e+00   3.700 0.000221 *** 
## DATESURVEY15-Feb-12    3.597e+00  6.858e-01   5.245 1.72e-07 *** 
## DATESURVEY16-Feb-12    2.742e+00  2.183e+00   1.256 0.209159  
## DATESURVEY17-Feb-12    5.495e+00  4.316e+00   1.273 0.203144  
## DATESURVEY21-Feb-12    4.806e+00  4.326e+00   1.111 0.266704  
## DATESURVEY22-Feb-12    3.363e+00  6.446e-01   5.218 1.99e-07 *** 
## DATESURVEY23-Feb-12    2.923e+00  6.787e-01   4.308 1.73e-05 *** 
## DATESURVEY24-Feb-12    4.732e+00  6.743e-01   7.018 3.05e-12 *** 
## DATESURVEY27-Feb-12    3.966e+00  4.323e+00   0.917 0.359067  
## DATESURVEY28-Feb-12    5.757e+00  6.317e-01   9.113 < 2e-16 *** 
## DATESURVEY29-Feb-12    5.419e+00  6.589e-01   8.224 3.44e-16 *** 
## DATESURVEY31-Jan-12    3.329e+00  6.546e-01   5.084 4.02e-07 ***
```

```

## PARISHBukiro      5.083e+00  2.218e+00  2.292 0.022014 *
## PARISHBwengure   2.295e+00  4.330e+00  0.530 0.596107
## PARISHKabarama   3.956e+00  7.802e-01  5.070 4.33e-07 ***
## PARISHKakigaani -3.375e+00  9.041e-01 -3.734 0.000194 ***
## PARISHKamomo     -2.593e+00  7.955e-01 -3.259 0.001135 **
## PARISHKibingo_Bugamba NA       NA       NA       NA
## PARISHKibingo_Kagogi  NA       NA       NA       NA
## PARISHKigaaga    2.192e+00  8.043e-01  2.725 0.006477 **
## PARISHKitojo     NA       NA       NA       NA
## PARISHKitunguru  1.235e+00  1.406e+00  0.878 0.380068
## PARISHKongoro    4.359e-01  7.452e-01  0.585 0.558667
## PARISHKyandahi   -1.844e+00  4.343e+00 -0.424 0.671293
## PARISHMirama     -5.088e-01  8.610e-01 -0.591 0.554666
## PARISHMirongo   9.979e-01  7.461e-01  1.337 0.181220
## PARISHMitoozo   2.121e+00  8.037e-01  2.639 0.008376 **
## PARISHNcune      NA       NA       NA       NA
## PARISHNdeija     NA       NA       NA       NA
## PARISHNgango     1.904e+00  7.446e-01  2.557 0.010625 *
## PARISHNgoma     -2.100e+00  7.272e-01 -2.887 0.003924 **
## PARISHNgugo     -4.285e-01  7.413e-01 -0.578 0.563239
## PARISHNsinka    NA       NA       NA       NA
## PARISHNtuura   -1.915e+00  4.320e+00 -0.443 0.657597
## PARISHNyabikungu NA       NA       NA       NA
## PARISHNyabisirira NA       NA       NA       NA
## PARISHNyaihangna NA       NA       NA       NA
## PARISHNyakabare  3.312e+00  9.385e-01  3.529 0.000426 ***
## PARISHNyakaikara -4.459e+00  8.047e-01 -5.541 3.39e-08 ***
## PARISHNyanja    7.153e-01  2.197e+00  0.326 0.744809
## PARISHNyarubungo_Bwizibwera -2.068e-01  4.332e+00 -0.048 0.961934
## PARISHNyarubungo_Ndija  NA       NA       NA       NA
## PARISHNyaruhandagazi NA       NA       NA       NA
## PARISHOther      NA       NA       NA       NA
## PARISHRubingo   NA       NA       NA       NA
## PARISHRukarabo  NA       NA       NA       NA
## PARISHRweibogo  NA       NA       NA       NA
## PARISHRwensinga NA       NA       NA       NA
## PARISHRyamiyonga NA       NA       NA       NA
## ASSET_TOTAL      4.987e-04  8.778e-05  5.680 1.53e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.255 on 2063 degrees of freedom
##   (109 observations deleted due to missingness)
## Multiple R-squared:  0.6107, Adjusted R-squared:  0.6001
## F-statistic: 57.79 on 56 and 2063 DF,  p-value: < 2.2e-16

```

```

## Call:
## lm(formula = MAXBIDNOVEL ~ Improves_Health + Time_Money + Time_Money_Health +
##      FEMALE + WIFECOOK + Female_AGE + Female_MARRIED + Female_WIFECOOK +
##      Female_KNOLUNCH Dummy + Female_INCOME Dummy + Female_BUYWOOD DUMMY +

```

```

##      Female_GATHERWOOD_DUMMY + DATESURVEY + PARISH + ASSET_TOTAL -
## 1, data = data_plus, na.action = na.omit)
##
## Residuals:
##      Min     1Q Median     3Q    Max
## -13.092 -2.886 -1.108  1.378 73.641
##
## Coefficients: (17 not defined because of singularities)
##                                         Estimate Std. Error t value Pr(>|t|)
## Improves_Health                  0.1580285  0.3723965  0.424  0.671351
## Time_Money                      0.7907897  0.3656565  2.163  0.030681 *
## Time_Money_Health                -0.1444337  0.3600831 -0.401  0.688379
## FEMALE                          -4.6324561  1.2851336 -3.605  0.000320 ***
## WIFECOOK                         -0.2618225  0.5580965 -0.469  0.639023
## Female_AGE                      -0.0062805  0.0125194 -0.502  0.615959
## Female_MARRIED                  0.5378577  0.3856420  1.395  0.163253
## Female_WIFECOOK                 0.6036916  0.8422478  0.717  0.473601
## Female_KNOWLUNCH_Dummy          1.0218499  0.7523384  1.358  0.174538
## Female_INCOME_Dummy             1.0420003  0.4459230  2.337  0.019548 *
## Female_BUYWOOD_DUMMY            0.8127224  0.3680078  2.208  0.027323 *
## Female_GATHERWOOD_DUMMY         0.3648250  0.5322362  0.685  0.493132
## DATESURVEY01-Feb-12              6.1149952  0.9672522  6.322 3.15e-10 ***
## DATESURVEY01-Mar-12              5.8095987  0.9126966  6.365 2.39e-10 ***
## DATESURVEY02-Feb-12              5.8924158  0.9604056  6.135 1.01e-09 ***
## DATESURVEY03-Feb-12              8.0949763  0.9636308  8.400 < 2e-16 ***
## DATESURVEY06-Feb-12              10.7702776 1.0381984 10.374 < 2e-16 ***
## DATESURVEY07-Feb-12              7.2225357  0.9001641  8.024 1.70e-15 ***
## DATESURVEY08-Feb-12              13.5856997 0.9326925 14.566 < 2e-16 ***
## DATESURVEY09-Feb-12              10.6364348 1.0766340  9.879 < 2e-16 ***
## DATESURVEY10-Feb-12              11.7050176 1.0175446 11.503 < 2e-16 ***
## DATESURVEY14-Feb-12              6.1382486  1.7845922  3.440 0.000594 ***
## DATESURVEY15-Feb-12              5.4321092  0.9340574  5.816 6.98e-09 ***
## DATESURVEY16-Feb-12              8.4048152  3.0050202  2.797 0.005207 **
## DATESURVEY17-Feb-12              6.6482640  5.9493665  1.117 0.263921
## DATESURVEY21-Feb-12              6.0771568  5.9558996  1.020 0.307677
## DATESURVEY22-Feb-12              4.5779578  0.8848309  5.174 2.51e-07 ***
## DATESURVEY23-Feb-12              4.8333259  0.9558246  5.057 4.64e-07 ***
## DATESURVEY24-Feb-12              7.3970738  0.9178164  8.059 1.28e-15 ***
## DATESURVEY27-Feb-12              4.3127603  5.9553392  0.724 0.469035
## DATESURVEY28-Feb-12              8.9625031  0.8647260 10.365 < 2e-16 ***
## DATESURVEY29-Feb-12              7.7463990  0.8903257  8.701 < 2e-16 ***
## DATESURVEY31-Jan-12              4.5577234  0.9006947  5.060 4.56e-07 ***
## PARISHBukiro                     3.1266636  3.0503181  1.025 0.305469
## PARISHBwengure                   4.7377702  5.9606988  0.795 0.426801
## PARISHKabarama                  5.1903698  1.0741526  4.832 1.45e-06 ***
## PARISHKakigaani                 -3.7293952  1.2315829 -3.028 0.002491 **
## PARISHKamomo                     -1.7948029  1.1028054 -1.627 0.103785
## PARISHKibingo_Bugamba           NA          NA          NA          NA
## PARISHKibingo_Kagogi            NA          NA          NA          NA
## PARISHKigaaga                   2.0012119  1.0873474  1.840 0.065844 .
## PARISHKitojo                     NA          NA          NA          NA
## PARISHKitunguru                 2.2648948  1.9250046  1.177 0.239504
## PARISHKongoro                   -0.2731220 1.0293897 -0.265 0.790786
## PARISHKyandahi                  -2.0146662  5.9781937 -0.337 0.736149

```

```

## PARISHMirama          -1.3535938  1.1676275 -1.159  0.246480
## PARISHMirongo         1.3437494  1.0223873  1.314  0.188882
## PARISHMitoozo         2.0042804  1.1291070  1.775  0.076028 .
## PARISHNcune            NA          NA          NA          NA
## PARISHNdeija           NA          NA          NA          NA
## PARISHNgango           3.4580956  1.0170479  3.400  0.000686 ***
## PARISHNgoma            -3.8626767  0.9952404 -3.881  0.000107 ***
## PARISHNgugo            -0.5430646  1.0382548 -0.523  0.600992
## PARISHNsinka           NA          NA          NA          NA
## PARISHNtuura           -1.1449360  5.9559706 -0.192  0.847578
## PARISHNyabikungu      NA          NA          NA          NA
## PARISHNyabisirira     NA          NA          NA          NA
## PARISHNyaihangha      NA          NA          NA          NA
## PARISHNyakabare        3.4959973  1.2857082  2.719  0.006600 **
## PARISHNyakaikara      -5.1487438  1.1138291 -4.623  4.02e-06 ***
## PARISHNyanja           -2.3662683  3.0253441 -0.782  0.434217
## PARISHNyarubungo_Bwizibwera 1.1028110  5.9690915  0.185  0.853440
## PARISHNyarubungo_Ndija NA          NA          NA          NA
## PARISHNyaruhandagazi  NA          NA          NA          NA
## PARISHOther             NA          NA          NA          NA
## PARISHRubingo           NA          NA          NA          NA
## PARISHRukarabo          NA          NA          NA          NA
## PARISHRweibogo          NA          NA          NA          NA
## PARISHRwensinga          NA          NA          NA          NA
## PARISHRyamiyongwa       NA          NA          NA          NA
## ASSET_TOTAL              0.0005895  0.0001199  4.915  9.56e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 5.867 on 2075 degrees of freedom
##   (99 observations deleted due to missingness)
## Multiple R-squared:  0.6162, Adjusted R-squared:  0.6062
## F-statistic: 61.69 on 54 and 2075 DF,  p-value: < 2.2e-16

```

```
data.frame(summary(lm13)$coefficients[1:15, c(1,2,4)])
```

	Estimate	Std..Error	Pr...t..
## Improves_Health	1.084439968	0.268762488	5.660759e-05
## Time_Money	0.181195332	0.268425807	4.997327e-01
## Time_Money_Health	0.317350704	0.261876946	2.257157e-01
## FEMALE	-2.765277209	0.947838447	3.567148e-03
## WIFECOOK	-0.432165926	0.406567224	2.879231e-01
## Female_AGE	-0.008708995	0.009162858	3.419863e-01
## Female_MARRIED	0.316507948	0.309269363	3.062362e-01
## Female_WIFECOOK	0.608182670	0.612803764	3.210900e-01
## Female_JOINTDECISION	0.016018364	0.258092925	9.505176e-01
## Female_KNOWLUNCH_Dummy	0.501392095	0.550152830	3.622076e-01
## Female_INCOME_Dummy	0.583984712	0.328566725	7.565464e-02
## Female_TSF_PRIMARY	-0.214476158	0.261978395	4.130643e-01
## Female_BUYWOOD_DUMMY	0.489278074	0.268628685	6.869209e-02
## Female_GATHERWOOD_DUMMY	0.340876059	0.392531622	3.852742e-01
## DATESURVEY01-Feb-12	5.652753427	0.698314804	9.693138e-16

```

data.frame(summary(lm14)$coefficients[1:15, c(1,2,4)])

##                                     Estimate Std. Error   Pr...t..
## Improves_Health          0.158028460 0.37239653 6.713507e-01
## Time_Money                0.790789700 0.36565650 3.068146e-02
## Time_Money_Health        -0.144433680 0.36008313 6.883789e-01
## FEMALE                  -4.632456108 1.28513360 3.199445e-04
## WIFECOOK                 -0.261822486 0.55809652 6.390226e-01
## Female_AGE                -0.006280528 0.01251945 6.159586e-01
## Female_MARRIED            0.537857698 0.38564200 1.632534e-01
## Female_WIFECOOK            0.603691609 0.84224776 4.736013e-01
## Female_KNOWLUNCH_Dummy    1.021849949 0.75233839 1.745378e-01
## Female_INCOME_Dummy       1.042000262 0.44592295 1.954808e-02
## Female_BUYWOOD_DUMMY      0.812722430 0.36800777 2.732270e-02
## Female_GATHERWOOD_DUMMY   0.364824953 0.53223619 4.931322e-01
## DATESURVEY01-Feb-12       6.114995152 0.96725218 3.151404e-10
## DATESURVEY01-Mar-12       5.809598700 0.91269665 2.391934e-10
## DATESURVEY02-Feb-12       5.892415782 0.96040555 1.014885e-09

#bidprice_lms = data.frame(summary(lm1)$coefficients[,1],summary(lm1)$coefficients[,4],summary(lm3)$coefficients[,1])
#write.csv(bidprice_lms,"bidprice_lms.csv")

#bidpricenovel_lms =data.frame(summary(lm2)$coefficients[,1],summary(lm2)$coefficients[,4],summary(lm4)$coefficients[,1])
#write.csv(bidpricenovel_lms,"bidpricenovel_lms.csv")

#summary(lm1)$coefficients[,1]

```

## 6 Pay within a week vs pay within four weeks

```

# Form the dataset
prices = rep(1,2234*2)
prices[1:2234] = Data$MAXBID
prices[2235:4468] = Data$MAXBIDNOVEL
UNIQUE_HHID = rep(1,4468)
UNIQUE_HHID[1:2234] = Data$UNIQUE_HHID
UNIQUE_HHID[2235:4468] = Data$UNIQUE_HHID
Biddummy = rep(1,2234*2)
Biddummy[1:2234] = 0
Biddummy[2235:4468] = 1
intra_person = data.frame(prices, UNIQUE_HHID, Biddummy)

# run the OLS with fixed effect
library(plm)
lm15 = plm(prices ~ Biddummy,
           data = intra_person,
           index = c("UNIQUE_HHID"),
           model = "within")
summary(lm15)

## Oneway (individual) effect Within Model

```

```

## 
## Call:
## plm(formula = prices ~ Biddummy, data = intra_person, model = "within",
##       index = c("UNIQUE_HHID"))
##
## Unbalanced Panel: n = 2161, T = 1-2, N = 4260
##
## Residuals:
##      Min.    1st Qu.     Median    3rd Qu.     Max.
## -36.79409 -0.97927   0.00000   0.97927  36.79409
##
## Coefficients:
##             Estimate Std. Error t-value Pr(>|t|)
## Biddummy 1.958549  0.081341 24.078 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares: 18594
## Residual Sum of Squares: 14568
## R-Squared: 0.21651
## Adj. R-Squared: -0.59051
## F-statistic: 579.758 on 1 and 2098 DF, p-value: < 2.22e-16

```

## 7 Wealth Effect

```

ASSET_SQ = data_plus$ASSET_TOTAL^2
library(plm)
lm16 = plm(MAXBID ~ ASSET_TOTAL+ASSET_SQ+Improves_Health+Time_Money+Time_Money_Health+PARISH -1,
            data = data_plus,
            index = c("DATESURVEY"),
            model = "within")
summary(lm16)

## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = MAXBID ~ ASSET_TOTAL + ASSET_SQ + Improves_Health +
##       Time_Money + Time_Money_Health + PARISH - 1, data = data_plus,
##       model = "within", index = c("DATESURVEY"))
##
## Unbalanced Panel: n = 21, T = 1-138, N = 2119
##
## Residuals:
##      Min.    1st Qu.     Median    3rd Qu.     Max.
## -9.24155 -2.25365 -0.78284  1.13119  75.04257
##
## Coefficients: (15 dropped because of singularities)
##                 Estimate Std. Error t-value Pr(>|t|)
## ASSET_TOTAL      5.3325e-04 8.6311e-05 6.1782 7.784e-10 ***
## ASSET_SQ        -1.6746e-09 1.4521e-08 -0.1153 0.9082042
## Improves_Health  9.6830e-01 2.6283e-01  3.6841 0.0002354 ***

```

```

## Time_Money          8.3735e-02  2.6520e-01  0.3157  0.7522316
## Time_Money_Health   3.2982e-01  2.6091e-01  1.2641  0.2063244
## PARISHBujaga        4.6333e+00  8.0864e-01  5.7298  1.153e-08 ***
## PARISHBukiro         4.9730e+00  2.2293e+00  2.2308  0.0258015 *
## PARISHBwengure       2.8187e+00  4.3207e+00  0.6524  0.5142332
## PARISHKabarama      3.9115e+00  7.8316e-01  4.9945  6.392e-07 ***
## PARISHKakigaani     -3.4397e+00  9.0819e-01 -3.7875  0.0001565 ***
## PARISHKamomo          -2.1565e+00  7.9527e-01 -2.7117  0.0067489 **
## PARISHKigaaga        2.0763e+00  8.0261e-01  2.5869  0.0097512 **
## PARISHKitunguru      1.0498e+00  1.4111e+00  0.7439  0.4569942
## PARISHKongoro         4.2772e-01  7.4096e-01  0.5773  0.5638318
## PARISHKyandahi       -1.4895e+00  4.3211e+00 -0.3447  0.7303451
## PARISHMirama          -4.4867e-01  8.6596e-01 -0.5181  0.6044343
## PARISHMirongo         1.0097e+00  7.4830e-01  1.3493  0.1773898
## PARISHMitoozo         2.0829e+00  8.0834e-01  2.5767  0.0100426 *
## PARISHNgango          2.0602e+00  7.4924e-01  2.7498  0.0060151 **
## PARISHNgoma           -2.1989e+00  7.3050e-01 -3.0102  0.0026426 **
## PARISHNgugo           -5.8031e-01  7.4370e-01 -0.7803  0.4353062
## PARISHNtuura          -1.1117e+00  4.3204e+00 -0.2573  0.7969650
## PARISHNyakabare       3.0692e+00  9.3913e-01  3.2681  0.0011003 **
## PARISHNyanja          7.4385e-01  2.2062e+00  0.3372  0.7360310
## PARISHNyarubungo_Bwizibwera 7.3029e-01  4.3259e+00  0.1688  0.8659579
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:  42542
## Residual Sum of Squares: 38087
## R-Squared: 0.10471
## Adj. R-Squared: 0.085275
## F-statistic: 9.69797 on 25 and 2073 DF, p-value: < 2.22e-16

lm17= plm(MAXBIDNOVEL ~ ASSET_TOTAL+ASSET_SQ+Improves_Health+Time_Money+Time_Money_Health+PARISH -1,
           data = data_plus,
           index = c("DATESURVEY"),
           model = "within")

summary(lm17)

## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = MAXBIDNOVEL ~ ASSET_TOTAL + ASSET_SQ + Improves_Health +
##       Time_Money + Time_Money_Health + PARISH - 1, data = data_plus,
##       model = "within", index = c("DATESURVEY"))
##
## Unbalanced Panel: n = 21, T = 1-140, N = 2129
##
## Residuals:
##      Min. 1st Qu. Median 3rd Qu. Max.
## -12.8862 -2.8476 -1.1740  1.4152 74.8453
##
## Coefficients: (15 dropped because of singularities)
##              Estimate Std. Error t-value Pr(>|t|)
## ASSET_TOTAL 6.2923e-04 1.1960e-04 5.2612 1.578e-07 ***

```

```

## ASSET_SQ           -1.4120e-08 2.0065e-08 -0.7037 0.4817053
## Improves_Health    6.5037e-03 3.6523e-01 0.0178 0.9857944
## Time_Money         6.0435e-01 3.6243e-01 1.6675 0.0955725 .
## Time_Money_Health -1.4025e-01 3.6041e-01 -0.3891 0.6972169
## PARISHBujaga      5.4045e+00 1.1214e+00 4.8193 1.545e-06 ***
## PARISHBukiro       3.0911e+00 3.0747e+00 1.0053 0.3148530
## PARISHBwengure     6.0466e+00 5.9653e+00 1.0136 0.3108733
## PARISHKabarama    5.1685e+00 1.0815e+00 4.7788 1.886e-06 ***
## PARISHKakigaani   -3.8511e+00 1.2399e+00 -3.1061 0.0019212 **
## PARISHKamomo        -1.1652e+00 1.1042e+00 -1.0553 0.2914062
## PARISHKigaaga      1.8207e+00 1.0879e+00 1.6736 0.0943639 .
## PARISHKitunguru    2.0315e+00 1.9377e+00 1.0484 0.2945590
## PARISHKongoro      -3.7311e-01 1.0310e+00 -0.3619 0.7174743
## PARISHKyandahi     -7.9342e-01 5.9685e+00 -0.1329 0.8942581
## PARISHMirama       -1.1975e+00 1.1764e+00 -1.0179 0.3088425
## PARISHMirongo      1.3304e+00 1.0278e+00 1.2945 0.1956532
## PARISHMitoozo      1.9364e+00 1.1371e+00 1.7028 0.0887457 .
## PARISHNgango        3.6492e+00 1.0251e+00 3.5597 0.0003797 ***
## PARISHNgoma         -3.9886e+00 1.0014e+00 -3.9830 7.039e-05 ***
## PARISHNgugo         -6.8732e-01 1.0440e+00 -0.6583 0.5103964
## PARISHNtuura        2.2837e-01 5.9657e+00 0.0383 0.9694680
## PARISHNyakabare    3.1427e+00 1.2886e+00 2.4388 0.0148203 *
## PARISHNyanja        -2.2485e+00 3.0461e+00 -0.7381 0.4605159
## PARISHNyarubungo_Bwizibwera 2.6211e+00 5.9703e+00 0.4390 0.6606863
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:  79927
## Residual Sum of Squares: 72969
## R-Squared: 0.087045
## Adj. R-Squared: 0.067322
## F-statistic: 7.94409 on 25 and 2083 DF, p-value: < 2.22e-16

```

```
data.frame(summary(lm16)$coefficients[1:6, c(1,2,4)])
```

```

##                               Estimate Std..Error   Pr...t..
## ASSET_TOTAL      5.332467e-04 8.631134e-05 7.783710e-10
## ASSET_SQ        -1.674569e-09 1.452131e-08 9.082042e-01
## Improves_Health 9.682958e-01 2.628298e-01 2.353784e-04
## Time_Money       8.373468e-02 2.652013e-01 7.522316e-01
## Time_Money_Health 3.298232e-01 2.609086e-01 2.063244e-01
## PARISHBujaga    4.633317e+00 8.086412e-01 1.152714e-08

```

```
data.frame(summary(lm17)$coefficients[1:6, c(1,2,4)])
```

```

##                               Estimate Std..Error   Pr...t..
## ASSET_TOTAL      6.292285e-04 1.195976e-04 1.577888e-07
## ASSET_SQ        -1.411975e-08 2.006533e-08 4.817053e-01
## Improves_Health 6.503719e-03 3.652316e-01 9.857944e-01
## Time_Money       6.043464e-01 3.624344e-01 9.557248e-02
## Time_Money_Health -1.402489e-01 3.604129e-01 6.972169e-01
## PARISHBujaga    5.404483e+00 1.121436e+00 1.545014e-06

```

```

data_plus_log = data_plus[which(data_plus$ASSET_TOTAL >0), ]
lm18 = plm(log(MAXBID) ~ log(ASSET_TOTAL)+Improves_Health+Time_Money+Time_Money_Health+PARISH -1,
           data =data_plus_log ,
           index = c("DATESURVEY"),
           model = "within")
summary(lm18)

## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = log(MAXBID) ~ log(ASSET_TOTAL) + Improves_Health +
##       Time_Money + Time_Money_Health + PARISH - 1, data = data_plus_log,
##       model = "within", index = c("DATESURVEY"))
##
## Unbalanced Panel: n = 21, T = 1-134, N = 2013
##
## Residuals:
##      Min.    1st Qu.     Median    3rd Qu.     Max.
## -2.7108407 -0.4352731 -0.0062414  0.4410181  3.4099745
##
## Coefficients: (15 dropped because of singularities)
##              Estimate Std. Error t-value Pr(>|t|)
## log(ASSET_TOTAL) 0.0667297 0.0092069 7.2478 6.055e-13 ***
## Improves_Health 0.1437708 0.0426009 3.3748 0.0007529 ***
## Time_Money -0.0149884 0.0430190 -0.3484 0.7275670
## Time_Money_Health 0.0278490 0.0423180 0.6581 0.5105585
## PARISHBujaga 0.6047043 0.1295302 4.6684 3.240e-06 ***
## PARISHBukiro 1.6914247 0.4047231 4.1792 3.053e-05 ***
## PARISHBwengure 0.1888294 0.6841775 0.2760 0.7825811
## PARISHKabarama 0.6108859 0.1259185 4.8514 1.322e-06 ***
## PARISHKakigaani -0.6683475 0.1506947 -4.4351 9.710e-06 ***
## PARISHKamomo -0.2881312 0.1286713 -2.2393 0.0252489 *
## PARISHKigaaga 0.4261354 0.1316824 3.2361 0.0012319 **
## PARISHKitunguru 0.2493033 0.2240600 1.1127 0.2659890
## PARISHKongoro 0.0537628 0.1215227 0.4424 0.6582416
## PARISHKyandahi -0.6651714 0.6844607 -0.9718 0.3312604
## PARISHMirama -0.0605533 0.1428765 -0.4238 0.6717468
## PARISHMirongo 0.1901447 0.1187434 1.6013 0.1094693
## PARISHMitoozo 0.5539990 0.1303763 4.2492 2.245e-05 ***
## PARISHNgango 0.5079665 0.1210828 4.1952 2.847e-05 ***
## PARISHNgoma -0.6210332 0.1221653 -5.0835 4.055e-07 ***
## PARISHNgugo -0.1963265 0.1233408 -1.5917 0.1116038
## PARISHNtuura -0.4991460 0.6843475 -0.7294 0.4658590
## PARISHNyakabare 0.7945116 0.1521850 5.2207 1.971e-07 ***
## PARISHNyanja 0.8775088 0.3994411 2.1968 0.0281480 *
## PARISHNyarubungo_Bwizibwera -0.1817008 0.6854194 -0.2651 0.7909646
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares: 1063.7
## Residual Sum of Squares: 906.25
## R-Squared: 0.14802
## Adj. R-Squared: 0.12898

```

```

## F-statistic: 14.2469 on 24 and 1968 DF, p-value: < 2.22e-16

lm19 = plm(log(MAXBIDNOVEL) ~ log(ASSET_TOTAL)+Improves_Health+Time_Money+Time_Money_Health+PARISH -1,
            data =data_plus_log ,
            index = c("DATESURVEY"),
            model = "within")
summary(lm19)

## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = log(MAXBIDNOVEL) ~ log(ASSET_TOTAL) + Improves_Health +
##       Time_Money + Time_Money_Health + PARISH - 1, data = data_plus_log,
##       model = "within", index = c("DATESURVEY"))
##
## Unbalanced Panel: n = 21, T = 1-134, N = 2020
##
## Residuals:
##      Min.    1st Qu.     Median    3rd Qu.     Max.
## -2.888517 -0.406877 -0.020303  0.398247  3.296003
##
## Coefficients: (15 dropped because of singularities)
##              Estimate Std. Error t-value Pr(>|t|)
## log(ASSET_TOTAL)      0.0579605  0.0088245  6.5681 6.495e-11 ***
## Improves_Health      -0.0170195  0.0411005 -0.4141  0.678850
## Time_Money           0.1007474  0.0409810  2.4584  0.014041 *
## Time_Money_Health   -0.0594947  0.0406437 -1.4638  0.143405
## PARISHBujaga        0.5015232  0.1248542  4.0169 6.118e-05 ***
## PARISHBukiro         0.4532036  0.3881526  1.1676  0.243113
## PARISHBwengure       0.5798567  0.6566446  0.8831  0.377311
## PARISHKabarama      0.6524490  0.1209029  5.3965 7.614e-08 ***
## PARISHKakigaani     -0.5645564  0.1439725 -3.9213 9.109e-05 ***
## PARISHKamomo         -0.0190658  0.1235097 -0.1544  0.877336
## PARISHKigaaga       0.2447699  0.1243281  1.9687  0.049122 *
## PARISHKitunguru     0.3788907  0.2138300  1.7719  0.076561 .
## PARISHKongoro        -0.0946944  0.1180666 -0.8020  0.422625
## PARISHKyandahi       -0.4828527  0.6571633 -0.7348  0.462577
## PARISHMirama         -0.1228763  0.1361722 -0.9024  0.366976
## PARISHMirongo        0.0932632  0.1133974  0.8224  0.410922
## PARISHMitoozo        0.4047904  0.1275344  3.1740  0.001527 **
## PARISHNgango          0.7039678  0.1157031  6.0843 1.402e-09 ***
## PARISHNgoma           -0.8083808  0.1167470 -6.9242 5.907e-12 ***
## PARISHNgugo           -0.1229229  0.1192541 -1.0308  0.302777
## PARISHNtuura          -0.1007288  0.6568975 -0.1533  0.878146
## PARISHNyakabare       0.5992739  0.1455558  4.1171 3.994e-05 ***
## PARISHNyanja          -0.1526273  0.3833956 -0.3981  0.690604
## PARISHNyarubungo_Bwizibwera 0.2011374  0.6575347  0.3059  0.759716
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:  984.79
## Residual Sum of Squares: 837.99
## R-Squared: 0.14907
## Adj. R-Squared: 0.13012

```

```

## F-statistic: 14.4165 on 24 and 1975 DF, p-value: < 2.22e-16

data.frame(summary(lm18)$coefficients[1:6, c(1,2,4)])
```

	Estimate	Std. Error	Pr...t..
## log(ASSET_TOTAL)	0.06672974	0.009206867	6.055287e-13
## Improves_Health	0.14377084	0.042600869	7.529430e-04
## Time_Money	-0.01498838	0.043018966	7.275670e-01
## Time_Money_Health	0.02784899	0.042318033	5.105585e-01
## PARISHBujaga	0.60470431	0.129530217	3.239757e-06
## PARISHBukiro	1.69142468	0.404723058	3.053256e-05

```

data.frame(summary(lm19)$coefficients[1:6, c(1,2,4)])
```

	Estimate	Std. Error	Pr...t..
## log(ASSET_TOTAL)	0.05796052	0.008824485	6.495198e-11
## Improves_Health	-0.01701945	0.041100479	6.788504e-01
## Time_Money	0.10074743	0.040981047	1.404141e-02
## Time_Money_Health	-0.05949466	0.040643677	1.434048e-01
## PARISHBujaga	0.50152316	0.124854194	6.118443e-05
## PARISHBukiro	0.45320357	0.388152571	2.431126e-01

## 8 Machine Learning Model of prediction

### 8.1 Mixed effect model on bidprices

A regression model: Stepwise Selection.

```

library(MASS)

##
## Attaching package: 'MASS'

## The following object is masked from 'package:rstatix':
##      select

## The following object is masked from 'package:dplyr':
##      select

library(faraway)

## Warning: package 'faraway' was built under R version 3.6.3

## Registered S3 methods overwritten by 'lme4':
##   method           from
##   cooks.distance.influence.merMod car
##   influence.merMod        car
##   dfbeta.influence.merMod    car
##   dfbetas.influence.merMod   car
```

```

## 
## Attaching package: 'faraway'

## The following object is masked from 'package:GGally':
## 
##     happy

# Step 1. Variance-stabilizing transformation.
# Step 2. Linear mixed-effects model fit by maximum likelihood
lm_ss = lm((MAXBID)^0.5 ~ No_message+Improves_Health + Time_Money + Time_Money_Health+FEMALE + AGE + TSF_PRIMARY + PARISH + ASSET_TOTAL - 1, data = data_plus, na.action = na.omit)
summary(lm_ss)

## 
## Call:
## lm(formula = (MAXBID)^0.5 ~ No_message + Improves_Health + Time_Money +
##     Time_Money_Health + FEMALE + AGE + TSF_PRIMARY + PARISH +
##     ASSET_TOTAL - 1, data = data_plus, na.action = na.omit)
## 
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.2425 -0.4876 -0.0852  0.3619  7.0050
## 
## Coefficients: (1 not defined because of singularities)
##             Estimate Std. Error t value Pr(>|t|)    
## No_message        2.343e+00  1.139e-01 20.577 < 2e-16 ***
## Improves_Health    2.528e+00  1.168e-01 21.643 < 2e-16 ***
## Time_Money         2.359e+00  1.158e-01 20.370 < 2e-16 ***
## Time_Money_Health   2.407e+00  1.140e-01 21.120 < 2e-16 ***
## FEMALE            -2.101e-01  3.784e-02 -5.551 3.20e-08 ***
## AGE               -3.129e-03  1.220e-03 -2.565 0.010377 *  
## TSF_PRIMARY        -9.451e-02  3.728e-02 -2.535 0.011316 *  
## PARISHBujaga      6.389e-01  1.346e-01  4.747 2.20e-06 *** 
## PARISHBukiro      3.677e-01  1.342e-01  2.739 0.006207 **  
## PARISHBwengure    2.101e-01  1.277e-01  1.646 0.099922 .  
## PARISHKabarama    5.275e-01  1.262e-01  4.180 3.04e-05 *** 
## PARISHKakigaani  -2.041e-01  1.378e-01 -1.481 0.138761  
## PARISHKamomo      -5.905e-01  1.289e-01 -4.581 4.90e-06 *** 
## PARISHKibingo_Bugamba -2.277e-01  1.376e-01 -1.655 0.098048 .  
## PARISHKibingo_Kagogi -3.390e-01  1.294e-01 -2.620 0.008861 ** 
## PARISHKigaaga     5.209e-01  1.384e-01  3.764 0.000172 *** 
## PARISHKitunguru   -2.514e-01  1.382e-01 -1.819 0.069000 .  
## PARISHKongoro     1.326e-01  1.486e-01  0.893 0.372008  
## PARISHKyandahi    -4.645e-02  1.287e-01 -0.361 0.718125  
## PARISHMirama      -6.424e-01  1.292e-01 -4.971 7.21e-07 *** 
## PARISHMirongo     4.461e-01  1.359e-01  3.283 0.001042 ** 
## PARISHMitoozo     2.370e-02  1.252e-01  0.189 0.849851  
## PARISHNcune        -4.203e-02  1.346e-01 -0.312 0.754829  
## PARISHNdeija      -1.609e-01  1.339e-01 -1.202 0.229555  
## PARISHNgango      5.587e-01  1.452e-01  3.849 0.000122 *** 
## PARISHNgoma        -5.048e-02  1.335e-01 -0.378 0.705298  
## PARISHNgugo        -4.344e-01  1.287e-01 -3.374 0.000754 *** 
## PARISHNsinka      -6.611e-01  1.262e-01 -5.239 1.78e-07 *** 
## PARISHNsinka      -5.303e-01  1.259e-01 -4.213 2.62e-05 ***
```

```

## PARISHNtuura           -4.280e-01  1.276e-01 -3.356 0.000806 ***
## PARISHNyabikungu       4.822e-01  1.447e-01  3.333 0.000874 ***
## PARISHNyabisirira      -5.522e-01 1.350e-01 -4.092 4.45e-05 ***
## PARISHNyaihangha        5.144e-01  1.497e-01  3.436 0.000603 ***
## PARISHNyakabare         3.266e-01  1.579e-01  2.068 0.038747 *
## PARISHNyakaikara        -6.910e-02 1.344e-01 -0.514 0.607317
## PARISHNyanya             -4.363e-01 1.451e-01 -3.007 0.002670 **
## PARISHNyarubungo_Bwizibwera -1.197e-01 1.330e-01 -0.900 0.368144
## PARISHNyarubungo_Ndijia -1.490e-01 2.317e-01 -0.643 0.520159
## PARISHNyaruhandagazi   -4.834e-01 1.318e-01 -3.667 0.000252 ***
## PARISHOther               5.494e-03  7.419e-01  0.007 0.994092
## PARISHRubingo            -4.851e-01 1.326e-01 -3.659 0.000260 ***
## PARISHRukarabo            7.401e-02  1.266e-01  0.585 0.558916
## PARISHRweibogo            6.758e-02  1.382e-01  0.489 0.624945
## PARISHRwensinga           -9.263e-02 1.294e-01 -0.716 0.474220
## PARISHRyamiyonga          NA          NA          NA          NA
## ASSET_TOTAL                9.344e-05 1.507e-05  6.201 6.76e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7356 on 2074 degrees of freedom
##   (109 observations deleted due to missingness)
## Multiple R-squared:  0.891, Adjusted R-squared:  0.8887
## F-statistic: 376.9 on 45 and 2074 DF,  p-value: < 2.2e-16

```

```

lm_ss = lm((MAXBIDNOVEL)^0.5 ~ No_message+Improves_Health + Time_Money + Time_Money_Health+FEMALE + AGE
summary(lm_ss)

```

```

##
## Call:
## lm(formula = (MAXBIDNOVEL)^0.5 ~ No_message + Improves_Health +
##     Time_Money + Time_Money_Health + FEMALE + AGE + TSF_PRIMARY +
##     PARISH + ASSET_TOTAL - 1, data = data_plus, na.action = na.omit)
##
## Residuals:
##    Min      1Q  Median      3Q      Max
## -2.5850 -0.5170 -0.1460  0.3904  6.8808
##
## Coefficients: (1 not defined because of singularities)
##                               Estimate Std. Error t value Pr(>|t|)
## No_message                   2.891e+00  1.292e-01 22.376 < 2e-16 ***
## Improves_Health              2.901e+00  1.326e-01 21.878 < 2e-16 ***
## Time_Money                   3.021e+00  1.309e-01 23.085 < 2e-16 ***
## Time_Money_Health             2.860e+00  1.294e-01 22.107 < 2e-16 ***
## FEMALE                       -2.469e-01 4.366e-02 -5.655 1.78e-08 ***
## AGE                           -4.491e-03 1.399e-03 -3.210 0.001346 **
## TSF_PRIMARY                  -1.002e-01 4.309e-02 -2.325 0.020180 *
## PARISHBujaga                 7.007e-01 1.535e-01  4.566 5.26e-06 ***
## PARISHBukiro                 4.329e-01 1.516e-01  2.856 0.004337 **
## PARISHBwengure                3.500e-01 1.448e-01  2.418 0.015704 *
## PARISHKabarama                5.607e-01 1.436e-01  3.905 9.72e-05 ***
## PARISHKakigaani               -1.932e-01 1.563e-01 -1.237 0.216364
## PARISHKamomo                  -7.372e-01 1.468e-01 -5.022 5.55e-07 ***
## PARISHKibingo_Bugamba        -5.965e-01 1.577e-01 -3.781 0.000160 ***

```

```

## PARISHKibingo_Kagogi      -4.141e-01  1.468e-01 -2.821  0.004833 ***
## PARISHKigaaga            3.967e-01  1.570e-01  2.527  0.011566 *
## PARISHKitojo              -3.629e-01  1.577e-01 -2.301  0.021464 *
## PARISHKitunguru          1.179e-01  1.672e-01  0.705  0.480602
## PARISHKongoro             -2.079e-01  1.470e-01 -1.414  0.157401
## PARISHKyandahi            -8.438e-01  1.487e-01 -5.674  1.59e-08 ***
## PARISHMirama               4.548e-01  1.541e-01  2.951  0.003206 **
## PARISHMirongo              1.219e-01  1.424e-01  0.856  0.392369
## PARISHMitoozo              -1.424e-01  1.535e-01 -0.928  0.353540
## PARISHNcune                -4.473e-02  1.517e-01 -0.295  0.768087
## PARISHNdeija               5.354e-01  1.670e-01  3.206  0.001364 **
## PARISHNgango                1.215e-02  1.508e-01  0.081  0.935807
## PARISHNgoma                -5.892e-01  1.460e-01 -4.036  5.64e-05 ***
## PARISHNgugo                -8.623e-01  1.461e-01 -5.902  4.17e-09 ***
## PARISHNsinka               -7.311e-01  1.431e-01 -5.108  3.56e-07 ***
## PARISHNtuura               -4.494e-01  1.452e-01 -3.096  0.001988 **
## PARISHNyabikungu           6.232e-01  1.630e-01  3.823  0.000136 ***
## PARISHNyabisirira          -5.472e-01  1.570e-01 -3.484  0.000503 ***
## PARISHNyaihangha            4.988e-01  1.697e-01  2.939  0.003331 **
## PARISHNyakabare             1.694e-01  1.807e-01  0.938  0.348550
## PARISHNyakaikara            -3.001e-02  1.539e-01 -0.195  0.845438
## PARISHNyanja                -3.540e-01  1.657e-01 -2.136  0.032780 *
## PARISHNyarubungo_Bwizibwera -9.176e-02  1.491e-01 -0.615  0.538292
## PARISHNyarubungo_Ndiija     -3.454e-01  2.665e-01 -1.296  0.195115
## PARISHNyaruhandagazi        -7.014e-01  1.502e-01 -4.669  3.21e-06 ***
## PARISHOther                  -3.496e-01  8.570e-01 -0.408  0.683394
## PARISHRubingo                -5.056e-01  1.497e-01 -3.376  0.000748 ***
## PARISHRukarabo               1.993e-01  1.436e-01  1.388  0.165278
## PARISHRweibogo               6.700e-03  1.577e-01  0.042  0.966124
## PARISHRwensinga              -6.603e-02  1.479e-01 -0.447  0.655226
## PARISHRyamiyonga              NA          NA          NA          NA
## ASSET_TOTAL                  8.988e-05  1.748e-05  5.142  2.97e-07 ***
## ---

## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.85 on 2084 degrees of freedom
##   (99 observations deleted due to missingness)
## Multiple R-squared:  0.8965, Adjusted R-squared:  0.8942
## F-statistic:  401 on 45 and 2084 DF,  p-value: < 2.2e-16

```

## 8.2 Predicting if the bid is >\$10

### Logistic Regression

#### Model Construction

Split training and test data

```
library(tidymodels)
```

```
## Warning: package 'tidymodels' was built under R version 3.6.3
```

```
## -- Attaching packages ----- tidymodels 0.1.2 --
```

```

## v broom     0.7.2      v recipes    0.1.15
## v dials     0.0.9      v rsample    0.0.8
## v infer     0.5.3      v tune       0.1.2
## v modeldata 0.1.0      v workflows  0.2.1
## v parsnip    0.1.4      v yardstick  0.0.7

## Warning: package 'broom' was built under R version 3.6.3

## Warning: package 'dials' was built under R version 3.6.3

## Warning: package 'infer' was built under R version 3.6.3

## Warning: package 'modeldata' was built under R version 3.6.3

## Warning: package 'parsnip' was built under R version 3.6.3

## Warning: package 'recipes' was built under R version 3.6.3

## Warning: package 'rsample' was built under R version 3.6.3

## Warning: package 'tune' was built under R version 3.6.3

## Warning: package 'workflows' was built under R version 3.6.3

## Warning: package 'yardstick' was built under R version 3.6.3

## -- Conflicts ----- tidymodels_conflicts() --
## x plm::between()      masks data.table::between(), dplyr::between()
## x infer::chisq_test()  masks rstatix::chisq_test()
## x scales::discard()   masks purrr::discard()
## x rstatix::filter()   masks dplyr::filter(), stats::filter()
## x data.table::first()  masks dplyr::first()
## x recipes::fixed()    masks stringr::fixed()
## x plm::lag()          masks dplyr::lag(), stats::lag()
## x data.table::last()   masks dplyr::last()
## x plm::lead()          masks dplyr::lead()
## x infer::prop_test()   masks rstatix::prop_test()
## x MASS::select()        masks rstatix::select(), dplyr::select()
## x yardstick::spec()    masks readr::spec()
## x recipes::step()      masks stats::step()
## x infer::t_test()      masks rstatix::t_test()
## x data.table::transpose() masks purrr::transpose()

data_plus_pred = data_plus
# the ratio of bids > $10
High_MAXBID_Ratio = sum(as.numeric(data_plus_pred$MAXBID) > 10, na.rm = TRUE) / length(data_plus_pred$MAXBID)
High_MAXBID_Ratio

## [1] 0.07944345

```

```

High_MAXBIDNOVEL_Ratio = sum(as.numeric(data_plus_pred$MAXBIDNOVEL) >10,na.rm = TRUE)/length(data_plus
High_MAXBIDNOVEL_Ratio

## [1] 0.1503591

data_plus_pred$ASSET_TOTAL = as.numeric(data_plus_pred$ASSET_TOTAL )

# convert to factors
data_plus_pred$MAXBID[as.numeric(data_plus_pred$MAXBID) >10] <- "more than $10"
data_plus_pred$MAXBID[as.numeric(data_plus_pred$MAXBID) <=10] <- "less or equal to $10"

## Warning in data_plus_pred$MAXBID[as.numeric(data_plus_pred$MAXBID) <= 10] <-
## "less or equal to $10": NAs introduced by coercion

data_plus_pred$MAXBID = as.factor(data_plus_pred$MAXBID)
n <- nrow(data_plus_pred)
census_parts <- data_plus_pred %>%
  initial_split(prop = 0.8)

train <- census_parts %>%
  training()

test <- census_parts %>%
  testing()

list(train, test) %>%
  map_int(nrow)

## [1] 1783 445

```

The ratio of bid more than \$10 for within a week auction is 7.94%, that for time payment auction is 15.04%.

```

pi_bar <- train %>%
  count(MAXBID) %>%
  mutate(pct = n / sum(n)) %>%
  filter(MAXBID == "more than $10") %>%
  pull(pct)
pi_bar

## [1] 0.07964105

# train %>%
#   count(MAXBID) %>%
#   mutate(pct = n / sum(n))
# mod_null <- logistic_reg(mode = "classification") %>%
#   set_engine("glm") %>%
#   fit(MAXBID ~ 1, data = train)
# library(yardstick)
# pred <- train %>%
#   select(MAXBID, ASSET_TOTAL) %>%

```

```

#   bind_cols(
#     predict(mod_null, new_data = train, type = "class")
#   ) %>%
#   rename(maxbid_null = .pred_class)

```

It shows that the accuracy is about 91.44%.

Another important tool in verifying a model's accuracy is called the confusion matrix (really). Simply put, this is a two-way table that counts how often our model made the correct prediction. Note that there are two different types of mistakes that our model can make: predicting a high income when the income was in fact low (a Type I error), and predicting a low income when the income was in fact high (a Type II error).

Examine bidprice on more variables

```

#
# mod_log_all <- logistic_reg(mode = "classification") %>%
#   set_engine("glm") %>%
#   fit(
#     MAXBID ~ Improves_Health + Time_Money + Time_Money_Health+FEMALE + AGE + MARRIED + KNOWLUNCH_Dummy
#     data = data_plus_pred
#   )
#
# pred <- pred %>%
#   bind_cols(
#     predict(mod_log_all, new_data = train, type = "class")
#   ) %>%
#   rename(maxbid_log_all = .pred_class)
#
# pred %>%
#   conf_mat(truth = MAXBID, estimate = maxbid_log_all)
#
# accuracy(pred, MAXBID, maxbid_log_all)

```

we have reached the final accuracy over 90.0%.