STAT 430 Final project

Yi Zhou

Due by midnight on 5/10/2021

1 Policies

Your task is to conduct an original data analysis. You must pose an original question, find a dataset, and conduct an analysis. You must submit a written document reporting your analysis.

1. Use this R notebook template to structure your report. When you're done, just knit this file and submit the resulting PDF on the course website. The report does not need to be in the form of a publishable paper.
2. There is no length requirement, just include enough detail to make and support the points you want to make.
3. This is an individual assignment and you must work alone.
4. You cannot study the same question as someone else in this class, since that chance that two people independently come up with the same question to study is very small.
5. You cannot study the same question you studied in the class so far. If you use the GSS dataset, your main independent and dependent variables must be different (you can still use the same control variables).
6. You cannot study the questions we posed as examples in class (cat vocal communication, electric cars, and SBA loans during COVID).
7. The specific grading criteria and point values are listed in the rest of the document.

2 Several things:

To meet the BLUF requirement, I've bolded my main point(for the section) at the beginning of each section.

I may have typed a bit much for this assignment. Since this is not an oral presentation, I want to explain my thoughts and findings in detail to avoid confusion. If you get confused, please contact me. I'd be happy to explain more.

3 Introduction (5 points)

Instructions:

- *Give context for your question (1 point)*

- *Cite at least one website, paper, or book to support the context (1 point)*
- *Explain the gap in the literature (1 point)*
- *State your research question in the form of "I will help X do Y by studying Z" (1 point)*
- *Use BLUF and write logically, and break your writing into separate paragraphs when appropriate (1 point)*

Question: What role does age play in the relationship between one's income and one's satisfaction level of his/her financial condition?

Main finding: More income would indicate more satisfaction with one's financial situation. This effect gets larger as age increases. The number of children also matters in this relation for middle-aged and very old people. My result is significant only when we are studying fully-employed people.

As we all know, if you are doing a business or selling a product, it is crucial to know your customers' income levels. As mentioned in https://blog.goebt.com/why-your-customers-income-level-is-so-important, knowing their customers' income levels can help companies in various ways, including targeting their markets, improving their services, establishing marketing plans, and pricing. The research paper https://www.sciencedirect.com/science/article/pii/S0140673613624174 is also an example that demonstrates the importance of people's income information.

In addition to income information, knowing if the customers are satisfied with their financial situation is also essential. For example, customers with different levels of confidence in their financial conditions would most likely be interested in different types of financial products.

Usually, income is a good predictor of people's confidence/satisfaction level of their financial conditions. Many studies have shown that more income would indicate a higher satisfaction level of one's financial condition. However, not every researcher has considered the effect of age in this relationship. In this project, I want to study the role of age in the relationship between one's income and one's satisfaction level of his/her financial condition.

I will help companies earn more profit by studying the effect of age in the relationship between one's income and one's satisfaction level of his/her financial condition. As I've explained above, earning more profit results from better sevices, marketing, targeting, and pricing. These are all aspects that my study could contribute to.

4 Methods and materials (4 points)

Instructions:

- *Identify the source of your data (1 point)*
- *Describe and explain the variables you will use (1 point)*
- *Describe the methods you will use (1 point)*
- *Use BLUF and write logically, and break your writing into separate paragraphs when appropriate (1 point)*

I will use a subset of the GSS 2016 dataset and fit linear models, all with satfin as the response variable.

```r
library(foreign)
library(data.table)
```

```
## Warning: package 'data.table' was built under R version 4.0.4
```

```
library(ggplot2)
```

```
gss = read.dta("GSS2016.dta")
gss = data.table(gss)
#gss
gss_subset = gss[, .(sex = as.numeric(sex == "male"),
degree = as.numeric(degree),
work = as.numeric(wrkstat),
marital = as.numeric(marital),
age,
age_decade = as.factor(floor(age / 10)),
race = as.numeric(race == "white"),
hispanic = as.numeric(hispanic != "hispanic"),
attend = as.numeric(attend), ## code as ordinal
educ,
income = as.numeric(income16), ## code as ordinal
srcbelt = as.numeric(srcbelt == "other rural"),
happy = as.numeric(happy),
satfin = as.numeric(satfin),
childs
)]
## remove rows that are all NA
gss_subset = na.omit(gss_subset)
```

In this project, I will use a subset of the GSS 2016 Dataset. The General Social Survey (GSS) dataset monitors societal change and studies the growing complexity of American society. The GSS Data Explorer, from NORC at the University of Chicago, makes it easier than ever to use the data collected by the GSS. The data explorer can be found here: https://gssdataexplorer.norc.org/

Let's take a look at some important variables:

satfin(response): Satisfaction with financial situation

Questions associated with this variable: A. We are interested in how people are getting along financially these days. So far as you and your family are concerned, would you say that you are pretty well satisfied with your present financial situation, more or less satisfied, or not satisfied at all?

A value of 1 means "satisfied." A value of 2 means "more or less satisfied." A value of 3 means "not at all satisfied."

work(named wrkstat in the original dataset): Labor force status

Questions associated with this variable: Last week were you working full time, part time, going to school, keeping house, or what?

A value of 1 means working full time. A value of 2 means working part time. A value of 3 means not working at the time(temp). A value of 4 means unemployed. A value of 5 means retired. A value of 6 means in school. A value of 7 means keeping house.

age: age

age_decade: decade of age. For example, a value of 5 means 50-60 years old.

income: Total family income

childs: Number of children

Please refer to this link for detailed information https://gssdataexplorer.norc.org/variables/104/vshow Basically, a higher value indicates a higher annual family income.

Other variables are control variables. We used them in previous assignments. I'm sure you are familiar with them.

I have fitted 4 linear models in this project. The first one will use gss_subset as the dataset. Others will use subsets of gss_subset based on different values of the variable work. In my models, I used satfin as the response variable; age, childs, work, income as response variables (some of these four will also serve as control variables in some of my models); others as control variables. Interactions between variables will be included. I will use ggplots to visualize my results. I've printed 6 rows of my dataset gss_subset. I've also printed some distributions of the important variables.

```
head(gss_subset)
```

```
##    sex degree work marital age age_decade race hispanic attend educ income
## 1:   1      4    1       1  47          4    1        1      1   16     26
## 2:   1      2    1       5  61          6    1        1      1   12     19
## 3:   1      4    5       1  72          7    1        1      8   16     21
## 4:   0      2    2       1  43          4    1        1      7   12     26
## 5:   0      5    2       1  55          5    1        1      1   18     26
## 6:   0      3    7       1  53          5    1        1      1   14     20
##    srcbelt happy satfin childs
## 1:       0     2      1      3
## 2:       0     2      3      0
## 3:       0     1      2      2
## 4:       0     2      1      4
## 5:       0     1      1      2
## 6:       0     1      2      2
```

```
table(gss_subset$work)
```

```
## 
##    1    2    3    4    5    6    7    8 
## 1233  314   56  105  493   65  239   66
```

```
table(gss_subset$satfin)
```

```
## 
##    1    2    3 
##  726 1143  702
```

```
table(gss_subset$childs)
```

```
## 
##   0   1   2   3   4   5   6   7   8 
## 713 423 663 417 193  79  45  19  19
```

```
table(gss_subset$income)
```

```
## 
##   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19  20 
##  34  35  23  12  19  15  22  47  88  69  63  65  94 101 115 128 126 218 206 256 
##  21  22  23  24  25  26 
## 212 179 125  96  61 162
```

```
table(gss_subset$age_decade)
```

```
##
##   1   2   3   4   5   6   7   8
##  30 399 472 415 516 416 208 115
```

5 Results (20 points)

Instructions:

- *You must perform at least one regression analysis that controls for at least two variables (-10 points if you don't do this)*

5.1 Analysis 1 (6 points)

Instructions:

- *Explain what your first analysis is (1 point)*
- *Explain how your analysis will help answer the research question (1 point)*
- *Visualize the results in a graphic or a table (1 point)*
- *Describe the results in prose (1 point)*
- *Use BLUF and write logically, and break your writing into separate paragraphs when appropriate (1 point)*
- *Perform the correct analysis (1 point)*

Question: What role does age play in the relationship between one's income and one's satisfaction level of his/her financial condition?

Finding: More income would indicate more satisfaction with one's financial situation. This effect gets larger as age increases.

This analysis wants to answer the question: What role does age play in the relationship between one's income and one's satisfaction level of his/her financial condition?

Model:

```
fit1 = lm(satfin ~ work + sex + marital + income + degree + educ + age + childs+
            happy + srcbelt + attend + race + hispanic + age*income,data = gss_subset)
summary(fit1)
```

```
##
## Call:
## lm(formula = satfin ~ work + sex + marital + income + degree +
##     educ + age + childs + happy + srcbelt + attend + race + hispanic +
##     age * income, data = gss_subset)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.93728 -0.49932  0.02426  0.49223  1.63124
##
## Coefficients:
```

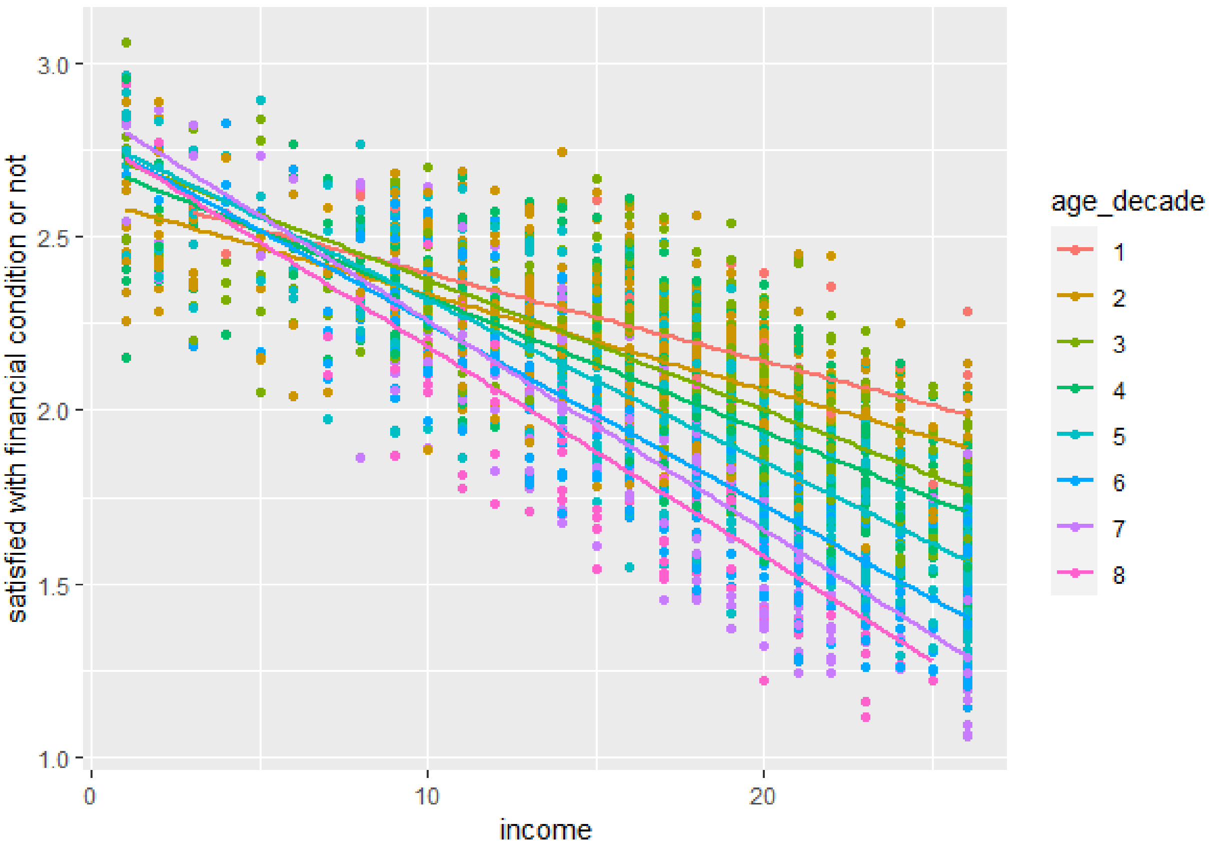
```
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.9622776  0.6897625   2.845 0.004478 **
## work        -0.0136039  0.0065856  -2.066 0.038957 *
## sex         -0.0909466  0.0269917  -3.369 0.000764 ***
## marital     -0.0024835  0.0098251  -0.253 0.800461
## income      -0.0070448  0.0068924  -1.022 0.306820
## degree      -0.0785446  0.0219892  -3.572 0.000361 ***
## educ         0.0165388  0.0091160   1.814 0.069754 .
## age          0.0022217  0.0023761   0.935 0.349867
## childs       0.0259241  0.0094248   2.751 0.005990 **
## happy        0.2456541  0.0215883  11.379  < 2e-16 ***
## srcbelt     -0.0113013  0.0428840  -0.264 0.792162
## attend      -0.0063553  0.0049657  -1.280 0.200716
## race        -0.0644576  0.0321557  -2.005 0.045117 *
## hispanic     0.1155170  0.6721767   0.172 0.863565
## income:age  -0.0005082  0.0001336  -3.803 0.000146 ***
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
## Residual standard error: 0.6702 on 2556 degrees of freedom
## Multiple R-squared:  0.1959, Adjusted R-squared:  0.1915
## F-statistic: 44.47 on 14 and 2556 DF,  p-value: < 2.2e-16
```

I’ve fitted a model with satfin as the response and other variables as the predictors and control variables. I’ve also included the interaction term income*age in my model. Our interaction term is significant. This interaction term will help us directly answer the research question by showing how income interact with age when predicting one’s satisfaction level of his/her financial condition. Also note that work and childs are significant, we will explore them in future analysis. Now let’s visualize our model and see what we can find.

Visualization:

```
viz_1 = gss_subset[, .(income,
satfin = predict(fit1,
newdata = gss_subset,
type = "response"),
age_decade)]
ggplot(data = viz_1) +
aes(x = income, y = satfin, color = age_decade) +
geom_point() +
geom_smooth(method = "lm", se = FALSE) +
ylab("satisfied with financial condition or not") +
xlab("income")
```

```
## ‘geom_smooth()‘ using formula ’y ~ x’
```



Before we interpret the result, note that a higher value in satfin means less satisfaction. As you can see from the plot, More income would indicate more satisfaction with one's financial situation. Also, we notice that there is a difference in slopes for different age decades. The absolute value in slope increases gets larger as age increases, meaning that the effect of income on satfin gets larges as age increases. In analysis 2 and analysis 3, I will explore why this difference in slope(effect) exists.

5.2 Analysis 2 (7 points)

Instructions:

- *Provide a possible explanation for the results you saw in Analysis 1 (1 point)*
- *Explain what your second analysis is (1 point)*
- *Explain how your analysis will help you better understand your Analysis 1 results (1 point)*
- *Visualize the results in a graphic or a table (1 point)*
- *Describe the results in prose (1 point)*
- *Use BLUF and write logically, and break your writing into separate paragraphs when appropriate (1 point)*
- *Perform the correct analysis (1 point)*

Question: Could the difference in effects be explained by different employment situations?

Finding: The difference in effect for different age groups is not explained by different employment statuses. Our analysis is only significant when the subject is working full-time.

In analysis one, we discovered that more income would indicate more satisfaction with one's financial situation. This effect gets larger as age increases. One possible explanation is that this relation is influenced by different employment statuses. For example, it is possible that some old people are more easily satisfied with their financial condition because they are retired. However, given the same family income, an old person that is still working full time may not be satisfied with their financial condition. Therefore, it is possible that the differences in effects for different age groups could be caused by changes in employment status. The effect gets larger because as age increases, more people have become retired, and thus have become satisfied with their financial condition. In this analysis, I want to test this explanation.

I want to analyze the following question: Could the difference in effects be explained by different employment situations?

This analysis will help me better understand my analysis one results by testing a possible explanation. It could also potentially help me modify my dataset so that my analysis 1 stays significant.

Models:

```
newdata2 <- gss_subset[ which(work==1),]
#newdata2
fit2 = lm(satfin ~ work + sex + marital + income + degree + educ + age + childs+
            happy + srcbelt + attend + race + hispanic + age*income,data = newdata2)
summary(fit2)
```

```
##
## Call:
## lm(formula = satfin ~ work + sex + marital + income + degree +
##     educ + age + childs + happy + srcbelt + attend + race + hispanic +
##     age * income, data = newdata2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.75124 -0.44969  0.00588  0.42649  1.54425
##
## Coefficients: (2 not defined because of singularities)
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.2343075  0.3058260   4.036 5.78e-05 ***
## work                NA         NA      NA       NA
## sex         -0.1070338  0.0377063  -2.839 0.004606 **
## marital      0.0141018  0.0130046   1.084 0.278415
## income       0.0227975  0.0138602   1.645 0.100266
## degree      -0.0776354  0.0303800  -2.555 0.010725 *
## educ         0.0187897  0.0130087   1.444 0.148886
## age          0.0240576  0.0064562   3.726 0.000203 ***
## childs       0.0428169  0.0144130   2.971 0.003029 **
## happy        0.2234677  0.0324099   6.895 8.62e-12 ***
## srcbelt     -0.0632732  0.0617451  -1.025 0.305685
## attend       0.0075137  0.0071894   1.045 0.296176
## race        -0.0233556  0.0442477  -0.528 0.597708
## hispanic            NA         NA      NA       NA
## income:age  -0.0014770  0.0003271  -4.515 6.95e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6478 on 1220 degrees of freedom
## Multiple R-squared:  0.1844, Adjusted R-squared:  0.1764
## F-statistic: 22.99 on 12 and 1220 DF,  p-value: < 2.2e-16
```

I've subsetted my dataset so that only fully-employed people are involved. Then, I fitted the same model using the new dataset to see if the result is different. As you can see from the summary, the interaction term is still significant.

```
newdata3 <- gss_subset[ which(work==5),]
#newdata3
fitretire = lm(satfin ~ work + sex + marital + income + degree + educ + age + childs+
            happy + srcbelt + attend + race + hispanic + age*income,data = newdata3)
summary(fitretire)
```

```
##
## Call:
## lm(formula = satfin ~ work + sex + marital + income + degree +
##     educ + age + childs + happy + srcbelt + attend + race + hispanic +
##     age * income, data = newdata3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.79394 -0.48771 -0.01607  0.46134  1.70890
##
## Coefficients: (2 not defined because of singularities)
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  3.489e+00  6.852e-01   5.092 5.09e-07 ***
## work                NA         NA      NA       NA
## sex         -8.531e-02  6.098e-02  -1.399  0.16246
## marital     -1.863e-02  2.830e-02  -0.658  0.51056
## income      -3.770e-02  3.547e-02  -1.063  0.28842
## degree      -1.021e-01  4.922e-02  -2.074  0.03858 *
## educ         6.793e-03  2.082e-02   0.326  0.74431
## age         -1.144e-02  8.635e-03  -1.325  0.18583
## childs       1.629e-03  1.830e-02   0.089  0.92911
## happy        1.472e-01  4.651e-02   3.165  0.00165 **
## srcbelt      3.588e-02  8.751e-02   0.410  0.68202
## attend      -1.727e-02  1.025e-02  -1.685  0.09258 .
## race        -2.142e-01  8.441e-02  -2.538  0.01147 *
## hispanic            NA         NA      NA       NA
## income:age  -3.549e-05  5.016e-04  -0.071  0.94362
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6507 on 480 degrees of freedom
## Multiple R-squared:  0.2513, Adjusted R-squared:  0.2326
## F-statistic: 13.43 on 12 and 480 DF,  p-value: < 2.2e-16
```

This is another subset of my original dataset(gss_subset). This dataset only includes people that have been retired. Then, I fitted the same model using this dataset. As you can see from the summary, the interaction term is no longer significant in this model. For other values in the work variable, I don't think there are enough observations for the models/analysis to be significant. Therefore, I conclude that our result in analysis 1 is only significant when we are considering fully-employed people.

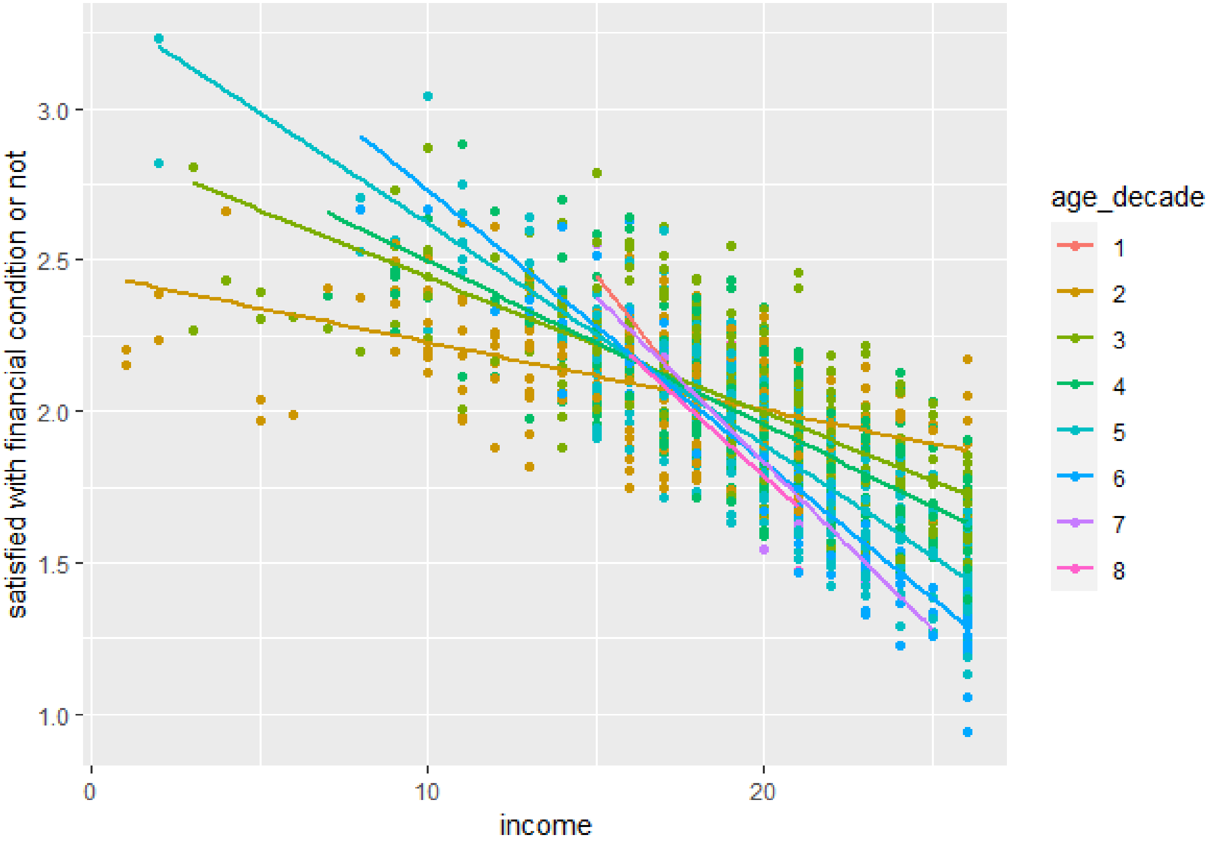
Visualizations:

```
viz_2 = newdata2[, .(income,
satfin = predict(fit2,
newdata = newdata2,
type = "response"),
age_decade)]
```

```
## Warning in predict.lm(fit2, newdata = newdata2, type = "response"): prediction
## from a rank-deficient fit may be misleading
```

```
ggplot(data = viz_2) +
aes(x = income, y = satfin, color = age_decade) +
geom_point() +
geom_smooth(method = "lm", se = FALSE) +
ylab("satisfied with financial condition or not") +
xlab("income")
```

```
## ‘geom_smooth()‘ using formula ’y ~ x’
```



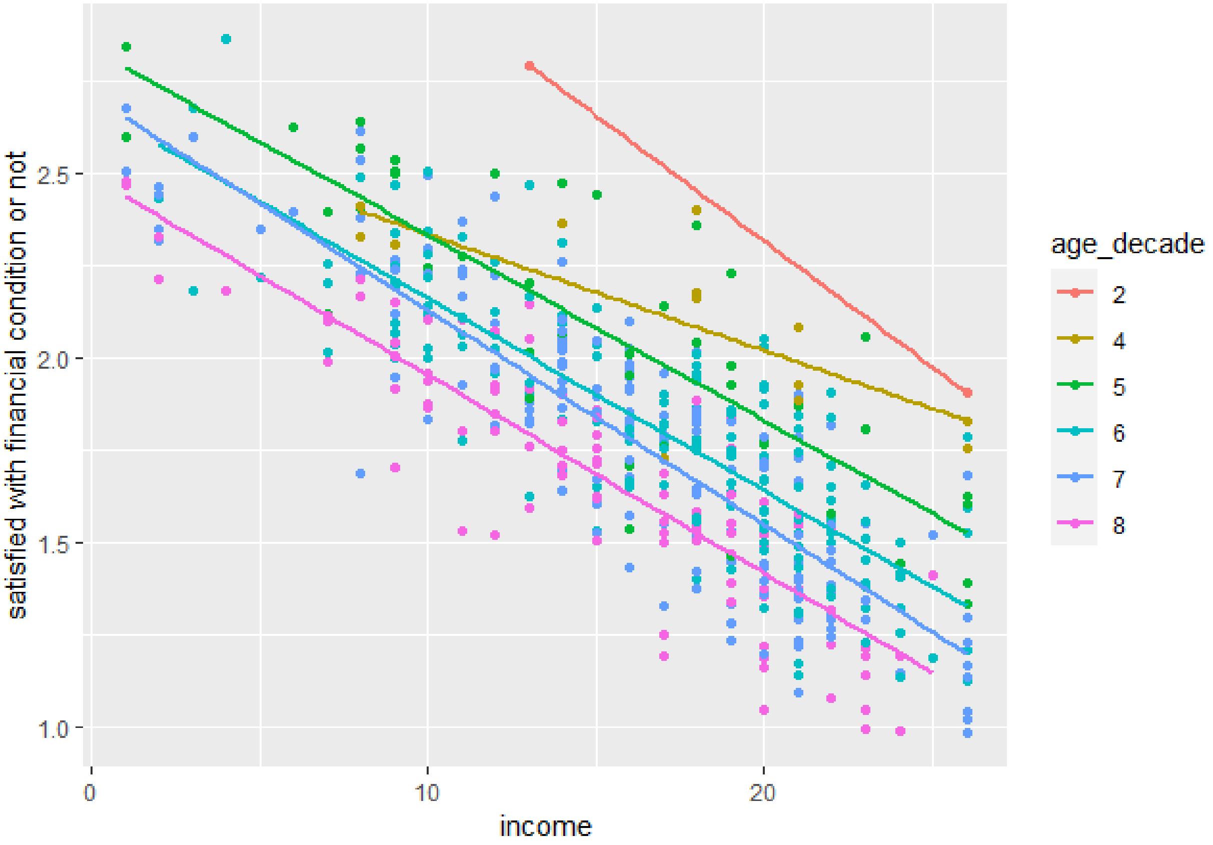
As you can see, the plot has changed a little bit compared to the one in our first analysis. However, the general trend stayed the same. More income would indicate more satisfaction with one’s financial situation. This effect gets larger as age increases. Therefore, we reject the explanation I proposed in this analysis. We conclude that the difference in effect for different age groups is not explained by different employment statuses. Our analysis is only significant when the subject is working full-time.

```
viz_retire = newdata3[, .(income,
satfin = predict(fitretire,
newdata = newdata3,
type = "response"),
age_decade)]
```

```
## Warning in predict.lm(fitretire, newdata = newdata3, type = "response"):
## prediction from a rank-deficient fit may be misleading
```

```
ggplot(data = viz_retire) +
aes(x = income, y = satfin, color = age_decade) +
geom_point() +
geom_smooth(method = "lm", se = FALSE) +
ylab("satisfied with financial condition or not") +
xlab("income")
```

```
## `geom_smooth()` using formula 'y ~ x'
```



The interaction term for the retired model is not significant. I just want to use this graph to show that the interaction term is indeed not significant in this model. We are not drawing conclusions from this graph.

5.3 Analysis 3 (7 points)

Instructions:

- *Provide a possible explanation for the results you saw in Analysis 2 (1 point)*
- *Explain what your third analysis is (1 point)*
- *Explain how your analysis will help you better understand your Analysis 2 results (1 point)*
- *Visualize the results in a graphic or a table (1 point)*
- *Describe the results in prose (1 point)*
- *Use BLUF and write logically, and break your writing into separate paragraphs when appropriate (1 point)*
- *Perform the correct analysis (1 point)*

Question: Does interaction between the number of children and age/income play an important role in the relationship between income and the satisfaction level of one's financial condition?

Answer: The interaction between number of children and age does play an important role in predicting the satisfaction level of one's financial condition. As the number of children increases, it becomes harder for middle-aged and very old people to be satisfied with their financial condition.

We have shown that the difference in effect is not explained by different employment statuses. Now we want to propose an alternative explanation for the result of analysis 1. So technically, analysis 3 is more related to analysis 1 and it is not closely related to analysis 2. I hope this is fine. I know it's not exactly what the rubric asked for, but since we rejected the explanation in analysis 2, it is natural that we propose another explanation. Analysis 2 did contribute a lot by finding a proper subset in which our analysis is significant.

The variable childs have been significant in both models in the previous two analyses. It is possible that the number of children also plays an important role in our analysis. Its interaction with age or income could also be significant. For example, it is possible that having children will result in a higher standard for one's financial situation. When people grow old, that standard may have dropped to normal because their children are now able to take care of themselves. In this analysis, we will test this explanation.

We want to answer the following question in this analysis: Does interaction between the number of children and age/income play an important role in our analysis?

Model:

```
fit3 = lm(satfin ~ work + sex + marital + income + degree + educ + age + childs+
            happy + srcbelt + attend + race + hispanic + childs*age + age*income + childs*income,data =
summary(fit3)
```

```
##
## Call:
## lm(formula = satfin ~ work + sex + marital + income + degree +
##     educ + age + childs + happy + srcbelt + attend + race + hispanic +
##     childs * age + age * income + childs * income, data = newdata2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.76298 -0.46963  0.01744  0.42756  1.52212
##
## Coefficients: (2 not defined because of singularities)
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.1189553  0.3083260   3.629 0.000296 ***
## work                  NA         NA      NA       NA
## sex           -0.1004995  0.0377434  -2.663 0.007854 **
## marital        0.0168914  0.0130372   1.296 0.195348
## income         0.0203401  0.0138666   1.467 0.142676
## degree        -0.0786781  0.0303415  -2.593 0.009626 **
## educ            0.0186174  0.0130029   1.432 0.152461
## age             0.0277782  0.0069491   3.997 6.79e-05 ***
## childs          0.1487822  0.0706512   2.106 0.035420 *
## happy           0.2185090  0.0324018   6.744 2.38e-11 ***
## srcbelt        -0.0631439  0.0616403  -1.024 0.305853
## attend          0.0078026  0.0071775   1.087 0.277211
## race           -0.0181580  0.0442006  -0.411 0.681284
## hispanic               NA         NA      NA       NA
## age:childs     -0.0029641  0.0011216  -2.643 0.008327 **
## income:age     -0.0014645  0.0003438  -4.259 2.21e-05 ***
## income:childs   0.0012977  0.0032458   0.400 0.689373
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6465 on 1218 degrees of freedom
## Multiple R-squared:  0.1891, Adjusted R-squared:  0.1798
## F-statistic: 20.29 on 14 and 1218 DF,  p-value: < 2.2e-16
```

I've included three interaction terms in this model, age:childs, age:income, and income:childs. The first two interaction terms are significant, meaning that the result in analysis 1 holds and the proposed explanation in analysis 3 could be true. Let's take a look at the plots.

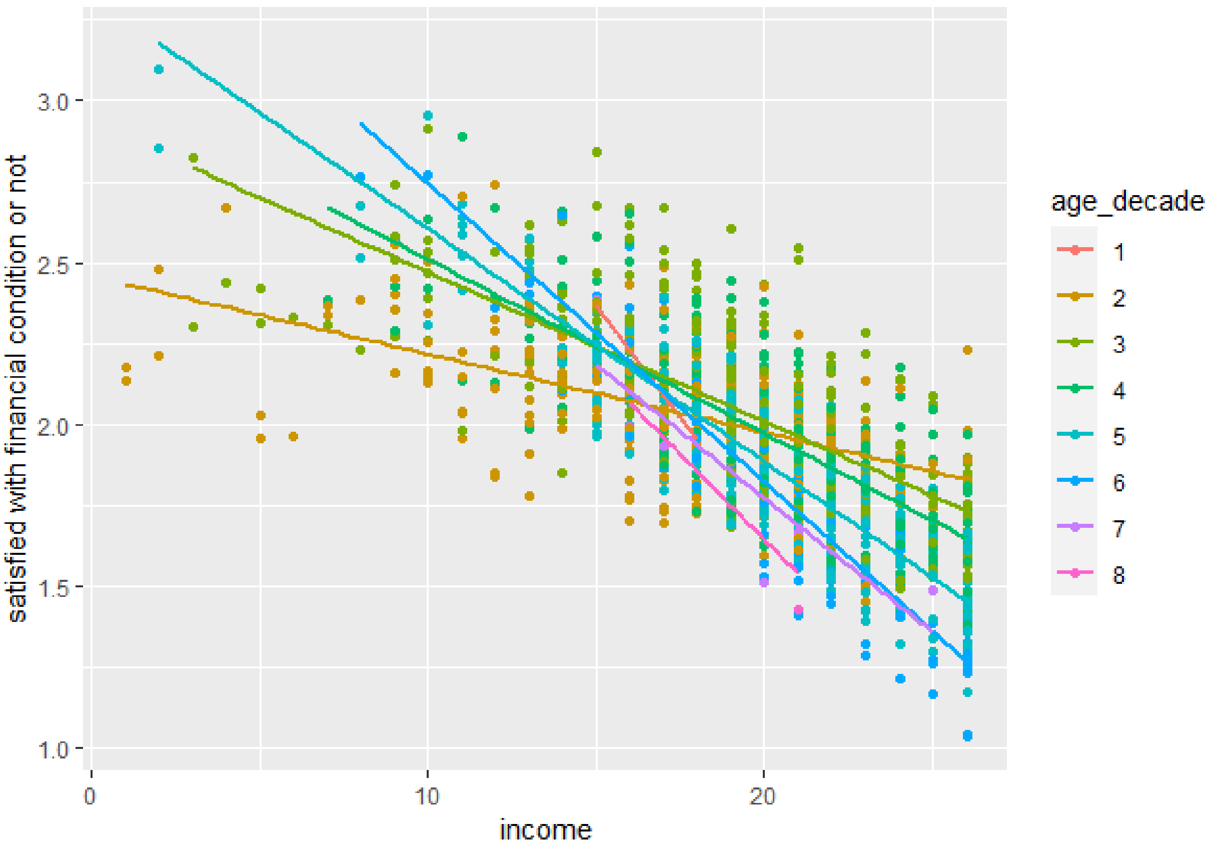
Visualizations:

```
viz_full1 = newdata2[, .(income,
satfin = predict(fit3,
newdata = newdata2,
type = "response"),
age_decade)]
```

```
## Warning in predict.lm(fit3, newdata = newdata2, type = "response"): prediction
## from a rank-deficient fit may be misleading
```

```
ggplot(data = viz_full1) +
aes(x = income, y = satfin, color = age_decade) +
geom_point() +
geom_smooth(method = "lm", se = FALSE) +
ylab("satisfied with financial condition or not") +
xlab("income")
```

```
## `geom_smooth()` using formula 'y ~ x'
```



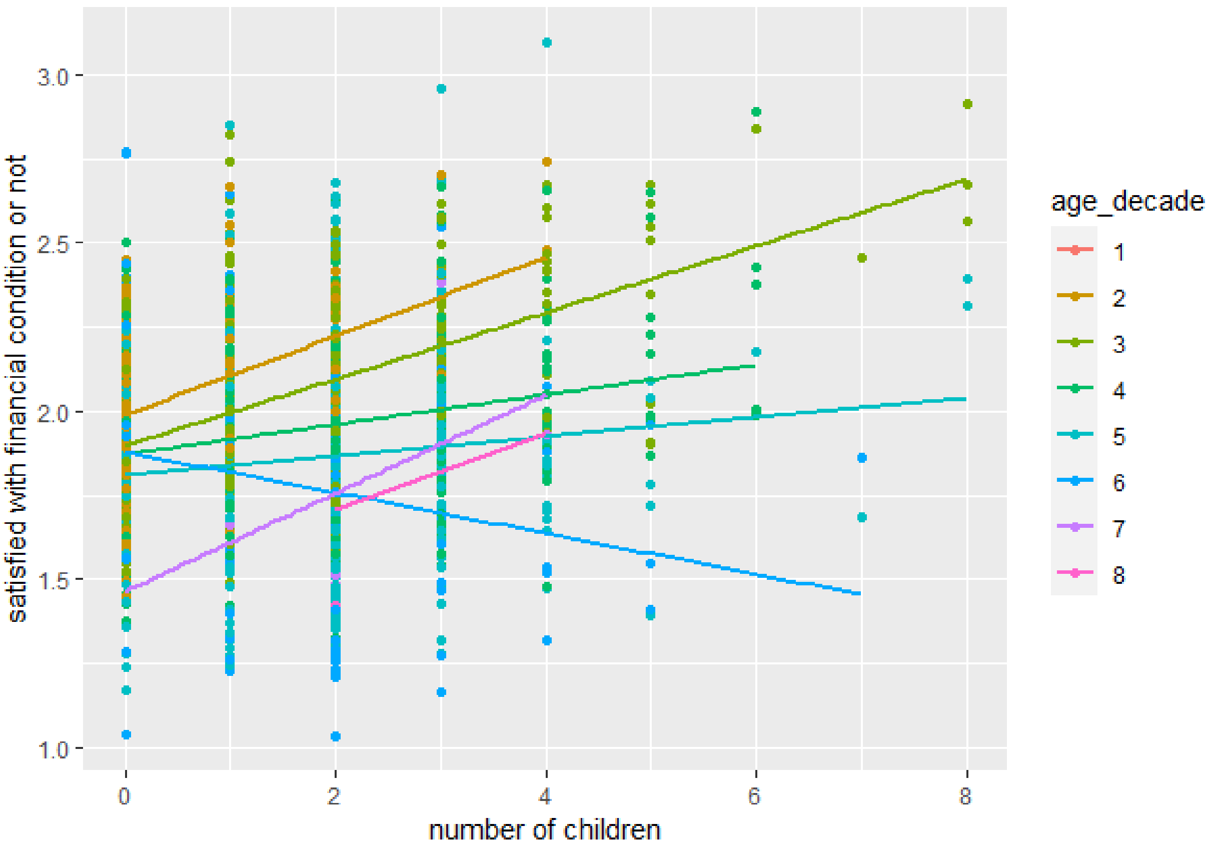
The plot about the interaction term income*age yields similar results as before, which is good.

```
viz_full2 = newdata2[, .(childs,
satfin = predict(fit3,
newdata = newdata2,
type = "response"),
age_decade)]
```

```
## Warning in predict.lm(fit3, newdata = newdata2, type = "response"): prediction
## from a rank-deficient fit may be misleading
```

```
ggplot(data = viz_full2) +
aes(x = childs, y = satfin, color = age_decade) +
geom_point() +
geom_smooth(method = "lm", se = FALSE) +
ylab("satisfied with financial condition or not") +
xlab("number of children")
```

```
## ‘geom_smooth()‘ using formula ’y ~ x’
```



This is the plot about the interaction term childs*age. As you can see from the plot, as the number of children increases, it becomes harder for middle-aged and very old people to be satisfied with their financial condition while the number of children does not matter that much for people between 40-69 years old.(Absolute value of the slopes are smaller. The slope even becomes negative for people in their 60s.) Therefore, we conclude that the interaction between the number of children and age does play an important role in predicting the satisfaction level of one's financial condition. As the number of children increases, it becomes harder(need more income) for middle-aged(or younger) and very old people to be satisfied with their financial condition.

One limitation of this analysis is that I haven't included the variable income in this interaction term because I don't really know how to handle three-way interactions and visualize them. Thus, the relationship between the interaction term age*childs and income remains unclear. Therefore, I guess I cannot say that I've explained the difference in effect in analysis 1. But it is fair to say that this is an interesting direction to look into.

6 Discussion (5 points)

Instructions:

- *Provide a possible explanation for the results you saw in Analysis 3 (1 point)*
- *Give an answer to your initial research question (1 point)*
- *Explain how your answer follows from the results of your three analyses (1 point)*
- *Provide one important implication of your answer (1 point)*
- *Use BLUF and write logically, and break your writing into separate paragraphs when appropriate (1 point)*

Conclusion: More income would indicate more satisfaction with one's financial situation. This effect gets larger as age increases. The number of children also matters in this relation for middle-aged and very old people. My result is significant only when we are studying fully-employed people.

In analysis 3, we found out that as the number of children increases, it becomes harder for middle-aged(or younger) and very old people to be satisfied with their financial condition. One possible explanation is that as the number of children increases, middle-aged people need to earn more money to feed their children and pay their tuition for school, and thus it is harder for them to be satisfied with their financial condition. This could also be true for very old people. One possible explanation is that as the number of children increases, very old people may want to leave more assets for their children as they pass away, and thus it could be hard for them to be satisfied with their financial situations. (This is just a guess.)

Combining the three analyses, my answer to the initial research question would be: More income would indicate more satisfaction with one's financial situation. This effect gets larger as age increases. The number of children also matters in this relation for middle-aged and very old people. My result is significant only when we are studying fully-employed people.

Let me summarize how I've arrived at this conclusion. To explore the role of age in the relationship between income and the satisfaction level of one's financial situation, I fitted a model that uses income to predict satisfaction and included an interaction term age*income. From the interaction term, I found out that the positive effect of income on satisfaction gets larger as age increases. Then, I proposed a possible explanation: Is it possible that the difference in effects results from changes in employment statuses? After testing, I found out that this explanation does not stand. I also found out that our results are only significant when we are considering fully-employed people. Thus, I subsetted the dataset. After the explanation was rejected, I proposed an alternative explanation for analysis 3: Is it possible that the difference in effects results from interactions between age and number of children. After fitting a model with more interaction terms, I found out that the term age:childs is significant, meaning that the alternative explanation could stand. However, since its relationship with income remains unclear, I can only conclude that the number of children also matters in the relation between income and satisfaction level of one's financial condition for middle-aged and very old people. This is how I've arrived at my conclusion.

I would say that my answer does have some implications, especially for companies and salesmen. I found out that the positive effect of income on satisfaction gets larger as age increases. This indicates that among people with high family income, a higher age would probably indicate a higher probability of being satisfied with their financial condition. This should be a piece of useful information in business. For example, if I was a salesman that sold financial product, I might want to offer a product that helps secure my customer's money(low risk, relatively-low return) if I notice that my customer is rich and old. Also, it might also be helpful to know if my customer has any children. Middle-aged people with kids would likely prefer products with lower risks because they have responsibilites to their children. (I'm sure real salesmen know better than I do. I'm just providing a situation where my study could be useful.)

7 References:

https://blog.goebt.com/why-your-customers-income-level-is-so-important

https://www.sciencedirect.com/science/article/pii/S0140673613624174

https://gssdataexplorer.norc.org/