Grooves & Gains: What music should you listen to when investing your $$$

Olive Oil Mashed Potatoes

2023-04-27

Contents

1 Introduction

Financial decisions involve uncertainty, meaning they can lead to either gains or losses (Levy, 2016). The context in which these decisions occur can affect how people behave. Factors like our thought processes and mood play a role in how we make financial choices and handle risk. Music, for instance, can significantly impact our mood (Dillman Carpentier and Potter, 2007; Husain et al., 2002; Thompson et al., 2001).

People often listen to music while doing various tasks, including making financial decisions. Research indicates that background music can influence both our thinking and behavior. For instance, the tempo of music can affect how quickly customers act (North and Hargreaves, 2009), and soothing music might boost overall cognitive performance (Cockerton et al., 1997). However, background music can also overload our mental capacity, leading to decreased efficiency (Thompson et al., 2012), especially when the task and music require processing in the same way.

Specific genres and tempos can have different effects. For instance, fast-paced and loud music, including certain types of classical music, garage music, and hip hop, can impair reading comprehension (Thompson et al., 2012; Furnham and Strbac, 2002; Chou, 2010).\

Understanding how music influences financial decisions is crucial for financial institutions, investors, and others in high-risk fields.

In this report, we analyze the factors affecting risk-taking in financial decisions and explore music-related strategies to improve decision-making and increase investment success.

2 Data

In this report, we utilized a behavioral questionnaire dataset from a study conducted on individuals related to music and financial risk taking. The variables of relevance include:

- **Group:** Categorical. The type of music played for the subject. 0= Slow tempo, 1=Fast tempo, 2= No music.
- **Mood before:** Categorical. Subjects chose between 10 options that best represent their mood prior to study.

- **Lot1-3:** Continuous. Numerical value representing the subjects performance on the lottery task of the study.
- **Inv A-C:** Continuous. Numerical value representing the subjects performance on the portfolio-diversification task of the study.
- **Age:** Continuous. Subjects age in years.
- **Gender:** Categorical. Subjects gender. 0=Male, 1=Female.
- **Marital:** Categorical. Subjects marital status. 1=single, 2=Married, 3= Divorced, 4=Widowed, 5= Separated.
- **Kids_no:** Continuous. Subjects number of children.
- **Birth_order:** Continuous. Position in family.
- **Residence:** Place of residence.
- **Religion:** Religion status.
- **Overdradt:** Often current bank account overdrawn.
- **Mood after:** Categorical. Subjects chose between 10 options that best represent their mood after studying.
- **music_rec:** Categorical. Is the music playing in the background familiar to the subject?
- **music_like:** Categorical. Did the subject like the music?
- **music_help:** Categorical. Does the subject think the music helped or disturbed them while they filled out the questionnaire?
- **music_effect:** Categorical. How did the music affect the subjects concentration?\
- **Earning:** Categorical. Does the subject have hearing problems?

```
## Loading required package: carData

## Loading required package: timechange

##
## Attaching package: 'lubridate'

## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union

## Warning: package 'rvest' was built under R version 4.2.3

## Warning: package 'olsrr' was built under R version 4.2.3

##
## Attaching package: 'olsrr'

## The following object is masked from 'package:datasets':
##
##     rivers

## corrplot 0.92 loaded

##
## Attaching package: 'MASS'

## The following object is masked from 'package:olsrr':
##
##     cement

##  [1] "serial"       "Group"        "Mood.before"  "Lot1"         "Lot2"
##  [6] "Lot3"         "invs_A"       "invs_B"       "invs_C"       "Age"
## [11] "Gender"       "Marital"      "Kids_no"      "Birth_order"  "residence"
## [16] "Religion"     "Overdradt"    "Mood.after"   "music_rec"    "music_like"
## [21] "music_effect" "music_help"   "earing"
```

3 Data Cleaning and Variable Creation

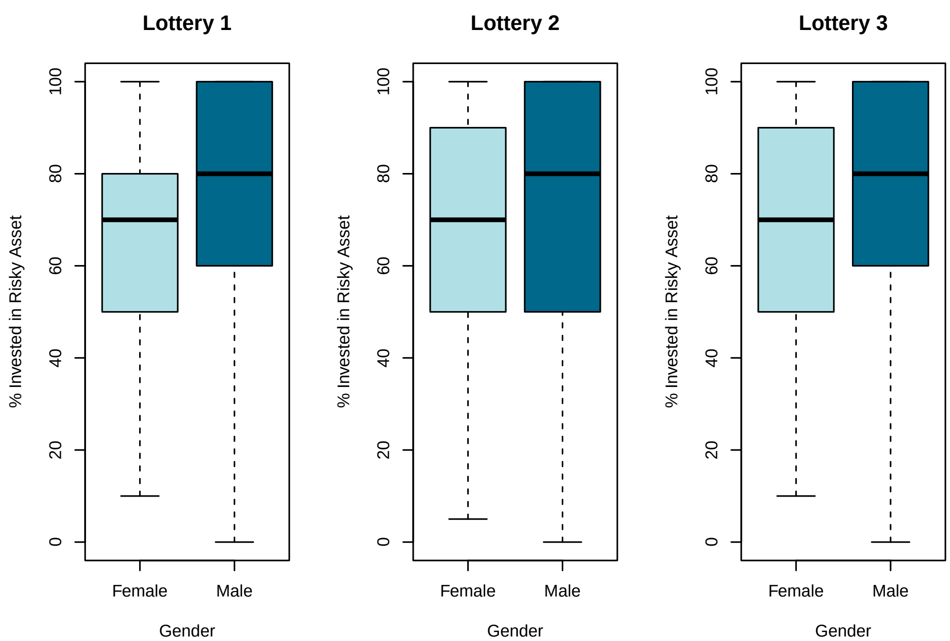
Main Issues in Dataset:

- **NA Values:** Variables such as **Lot1** had NA values instead of 0s.
- **Binary Categories:** Categorical variables like **Gender** used binary (0 or 1) inputs instead of text.
- **Variables with Limited Insight:** Variables like **InvA** ("coins" invested in security A) that do not reveal much about investment habits.
- **Grammatical and Format Issues:** Issues such as **Age** not being in numerical format.

Data Cleaning Steps:

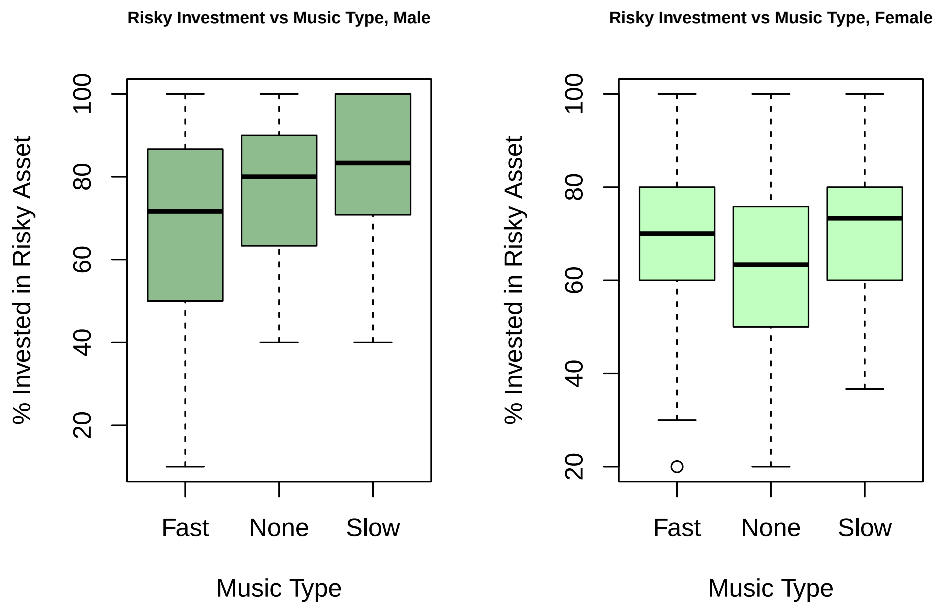
- **Handling NA Values:** Ran code to identify NA values in variable columns and replaced with '0'.
- **Data Type Conversion:** Used `as.numeric()` function to change numbers to numerical format.
- **Creating New Variables:** Created new variables such as **invs_return**, calculating expected return of participants' investments using `rowSums()` and `rowMeans()`.
- **Correcting Variable Names:** Ran code that identified and replaced misspelled variable names with corrected names.

4 Plots

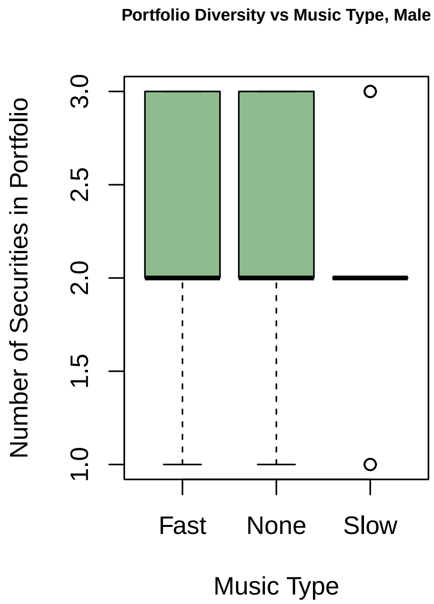


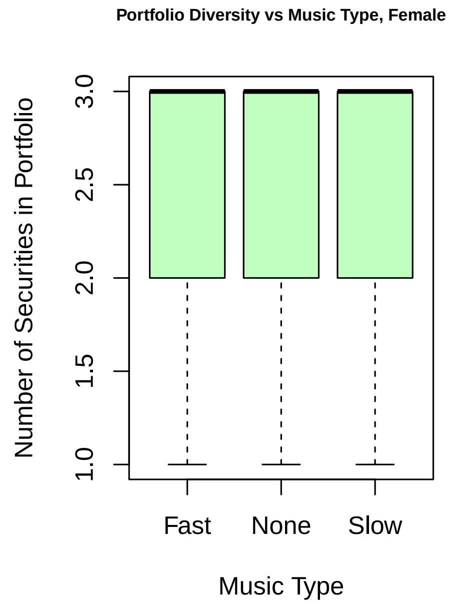

```
##
##  Welch Two Sample t-test
##
## data:  data$Lot_avg by data$gender
## t = -4.2324, df = 346.21, p-value = 2.965e-05
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 95 percent confidence interval:
##  -12.227829  -4.468774
## sample estimates:
## mean in group Female   mean in group Male
##             67.70238             76.05068
```

Based on these boxplots we observe that in lottery 1, 2 and 3, Females tend to invest a lower percentage (around 40%) in the risky asset compared to males (around 80%). The pattern is consistent across all three lotteries, indicating that males tend to invest a higher percentage in the risky asset compared to females. Additionally, the p-value is extremely small (0.000029), which suggests that the difference in means between the Female and Male groups is statistically significant. The 95% confidence interval for the difference in means is (-12.23, -4.47), which does not include 0. This further confirms that the means are significantly different between the two groups. The sample estimates show that the mean "lot_avg" for the Female group is 67.70, while for the Male group, it is 76.05. This aligns with the boxplot observations, where males tend to invest a higher percentage in the risky asset compared to females. Overall, both the boxplots and the t-test results indicate a significant difference in the investment behavior between males and females, with males investing a higher percentage in the risky asset compared to females across the three lotteries.

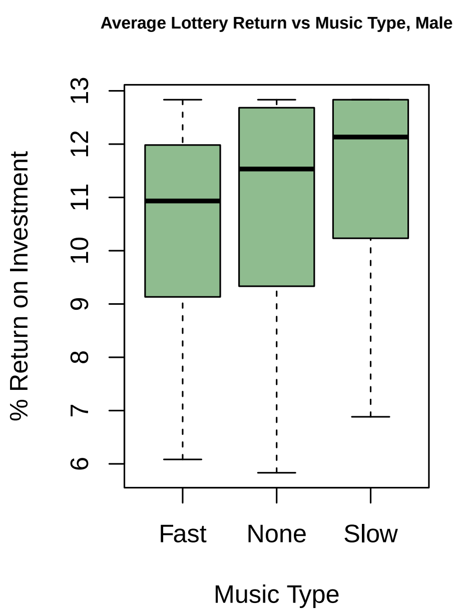


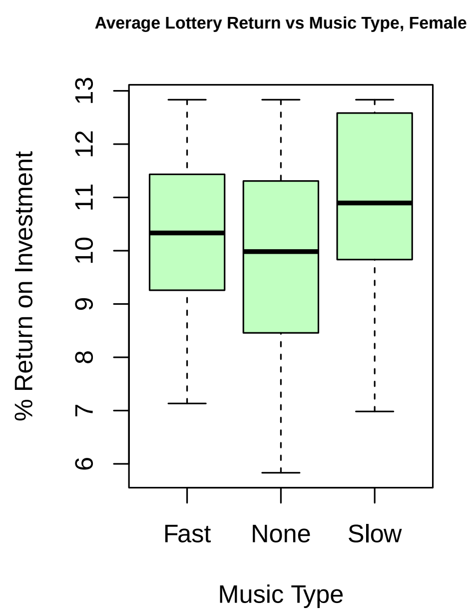
The boxplots display the relationship between music type (Fast, None, Slow) and the percentage invested in a risky asset, separately for males and females. For males: those who listened to slow music tended to invest the highest percentage (around 80-90%) in the risky asse, those who listened to no music invested a slightly lower percentage (around 60-80%) compared to slow music, and those who listened to fast music invested the lowest percentage (around 40-60%) in the risky asset. For females, the overall percentage invested in the risky asset is lower compared to males across all music types, similar to males those who listened to slow music tended to invest the highest percentage (around 60-80%) in the risky asset, and those who listened to no music or fast music invested lower percentages, with considerable overlap between the two groups (around 40-60%). Overall, for both genders, listening to slow music was associated with higher risk-taking behavior in terms of investment allocation compared to fast music or no music conditions. Additionally, females generally exhibited lower risk-taking behavior across all music types compared to males. These findings suggest that the type of music an individual listens to may influence their risk preferences and investment decisions, with slow music potentially promoting higher risk-taking tendencies, especially among males.



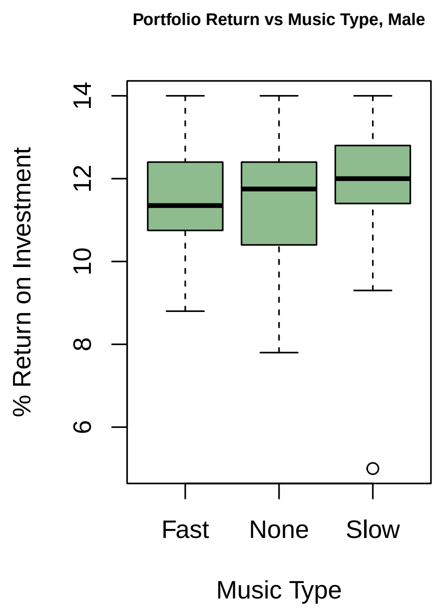


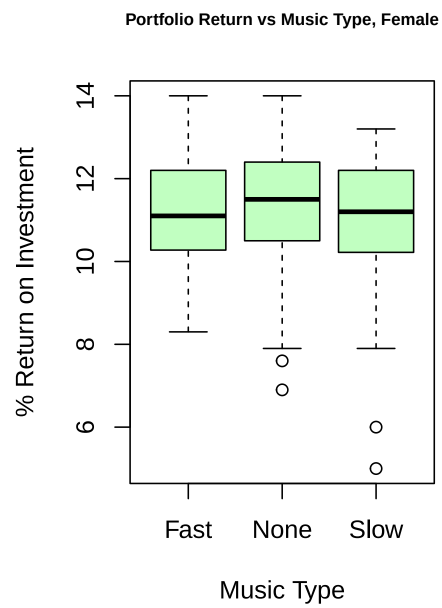
Based on the boxplots, for males, we observe that those who listened to fast music or no music had similar levels of portfolio diversity, with the median around 2.0-2.5 securities in their portfolio, while those who listened to slow music appeared to have slightly higher portfolio diversity, with the median around 3.0 securities. However, there is an outlier in the slow music group with a very high number of securities (around 6.0). For females, the distribution of portfolio diversity is very similar across all three music types (fast, none, slow), with the median portfolio diversity around 2.0-2.5 securities for all three groups, and little variation or difference is observed based on the music type for females. Overall, for males, listening to slow music seems to be associated with slightly higher portfolio diversity compared to fast music or no music conditions. However, this effect is not evident for females, where portfolio diversity appears to be unrelated to the type of music.



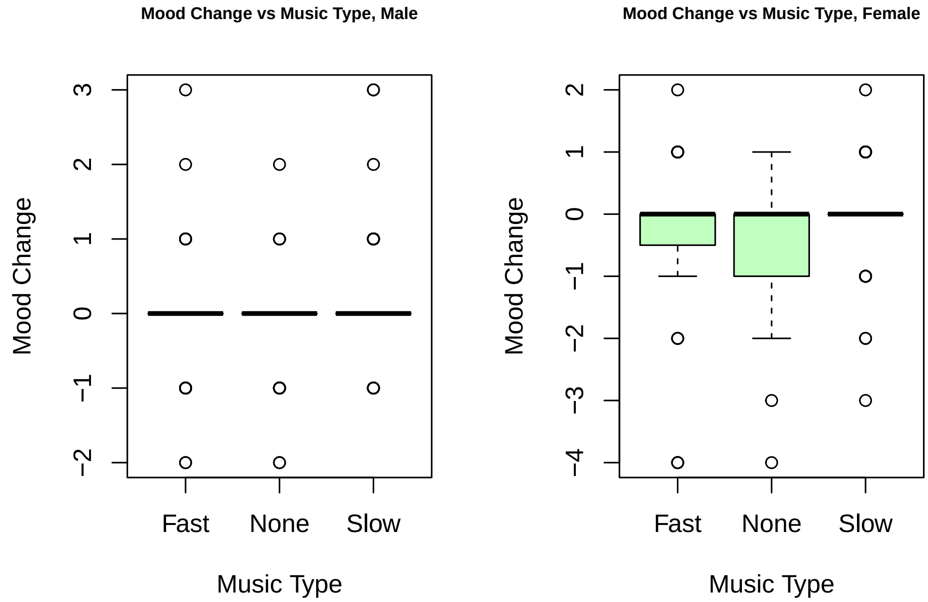


Based on the boxplots illustrating the average lottery return across different music types for males and females, we observe the following for males: those who listened to slow music tended to have the highest average lottery returns, with the median around 12-13%; those who listened to no music had slightly lower average returns compared to slow music, with the median around 10-11%; and those who listened to fast music had the lowest average lottery returns, with the median around 8-9%. For females, the distribution of average lottery returns is more compressed compared to males across all music types. Those who listened to slow music also tended to have the highest average returns, with the median around 10-11%. There is considerable overlap in the distributions for those who listened to fast music or no music, with the medians around 9-10%. Overall, for both males and females, listening to slow music was associated with higher average lottery returns compared to fast music or no music conditions. This trend is more pronounced for males, where the differences in median returns across music types are larger. These findings align with the previous observations on risky asset allocation, where slow music was linked to higher risk-taking behavior, potentially leading to higher returns on average from the lottery investment.

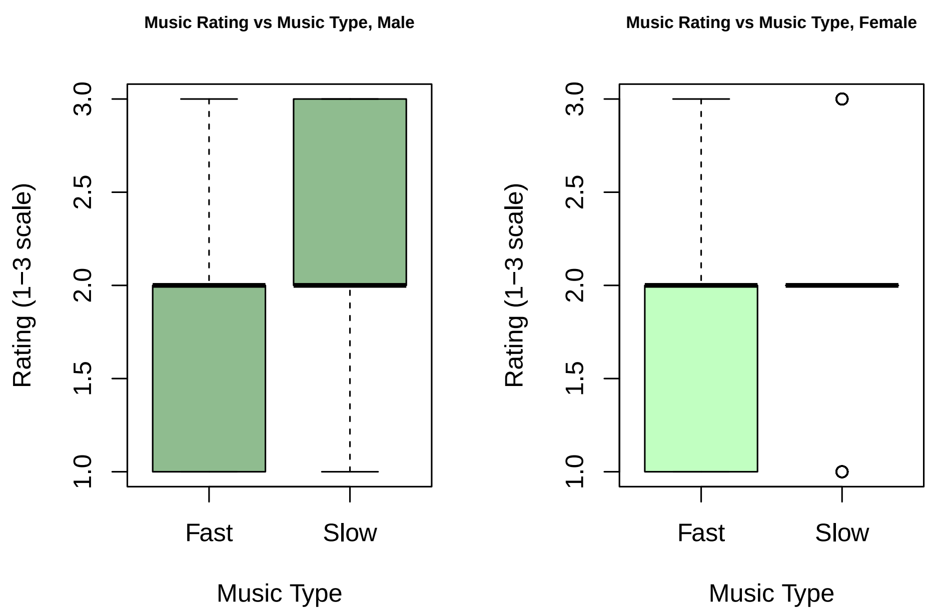




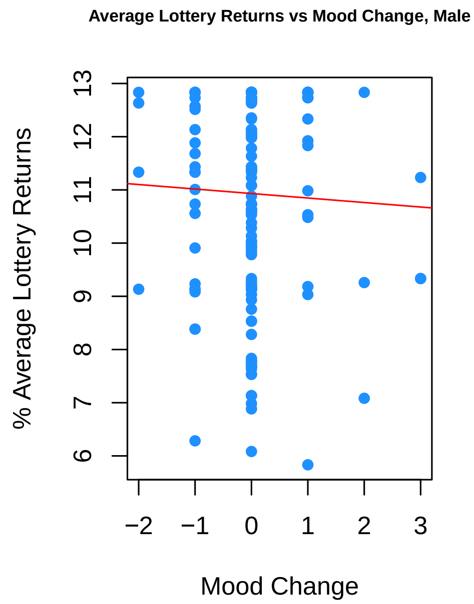
Based on the boxplots illustrating the average portfolio return across different music types for males and females, we observe the following for males: those who listened to fast music had a median return around 10% and a relatively narrow interquartile range (IQR), indicating low variability in returns. Those with no music had a median return slightly lower at around 9% and a relatively wider IQR, spanning from approximately 7% to 11.5%, suggesting higher variability. Those who listened to slow music had a median return similar to no music at around 9% but a relatively wider IQR, ranging from roughly 6.5% to 12%, indicating the highest variability among the three music types, and there are no apparent outliers for males across the music types. For females, we observe: those who listened to fast music had a median return around 10%, similar to males, and the IQR is relatively narrow, indicating low variability. Those who listened to no music had a median return slightly lower at around 9.5%, and a relatively wider IQR, spanning from approximately 8% to 11%, suggesting higher variability compared to fast music. Those who listened to slow music had a median return higher at around 11.5%, but the IQR is the widest, ranging from roughly 8% to 13%, indicating the highest variability among the three music types for females, and there are potential outliers observed in the “no music” and “slow music” conditions for females, represented by the dots below the whiskers. Overall, while median returns are generally similar across music types for both genders, the variability in returns tends to be higher with no music and even higher with slow music, especially for females. Additionally, females appear to have a slightly higher median return with slow music compared to the other conditions.

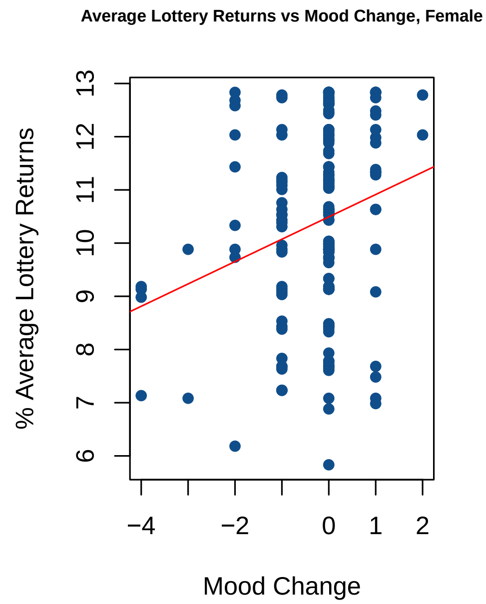


These boxplots illustrate the distribution of mood changes across different music types (fast, none, and slow) separately for males and females. For males, the median mood change remains consistently at 0 across all music conditions, with the interquartile ranges (IQRs) ranging from approximately -1 to 0.5 for fast music, -0.5 to 0.75 for no music, and -0.25 to 1 for slow music. This suggests that the type of music does not significantly impact mood for males overall, although there is slightly higher variability with slow music, as indicated by the wider IQR and the presence of outliers around 2.5 and -1.5. In contrast, for females, slow music appears to be associated with a positive median mood change of around 0.5 compared to around 0 for no music and -0.5 for fast music. Additionally, females exhibit greater variability than males, with the IQR for slow music spanning from -0.5 to 1.5 and outliers around 2 and -3. The wider distributions and more extreme outliers for females, especially with slow music, indicate greater individual variability in mood responses, which could be influenced by personal preferences or other factors not captured in this data.



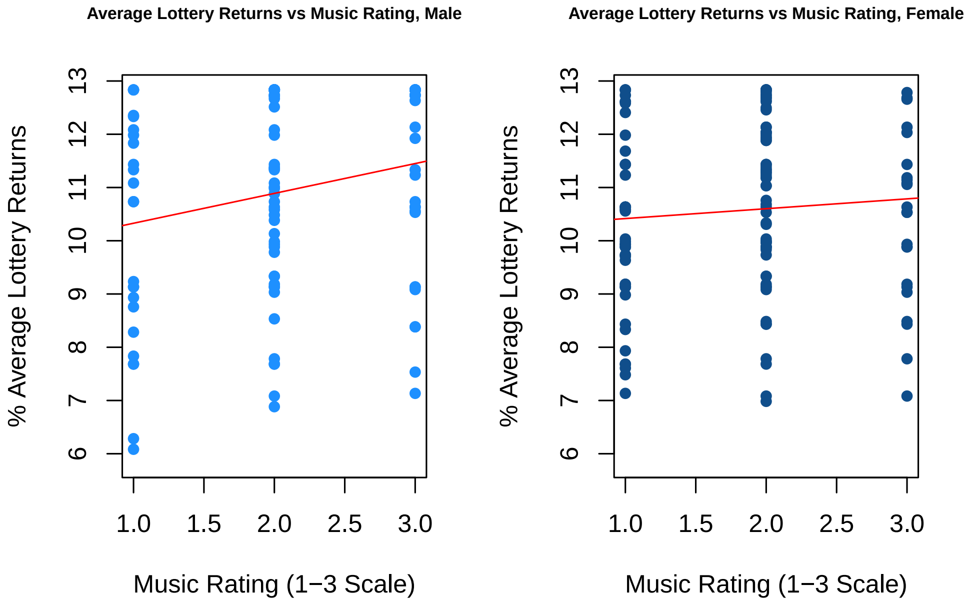
These boxplots depict the distribution of music ratings provided by males and females for fast and slow music types. For males, the median rating for fast music is around 1.5 on the provided scale, with the interquartile range (IQR) spanning from approximately 1.0 to 2.0. In contrast, the median rating for slow music is higher at 2.5, and the IQR is wider, ranging from roughly 2.0 to 3.0, indicating greater variability in ratings for slow music compared to fast music. Notably, no outliers are observed for males in either music condition. Turning to females, the median rating for fast music is similar to that of males, around 1.5, with a relatively narrow IQR from approximately 1.0 to 2.0. However, for slow music, the distribution is quite different. The median rating is lower than for fast music, around 1.5, and there is the presence of an outlier around 3.0. This outlier suggests that while most females rated slow music lower than fast music, some rated it substantially higher. Overall, the data indicates that males tend to prefer and exhibit less variability in their ratings for slow music, while females generally rate fast music higher but with a wider range of individual preferences for slow music.



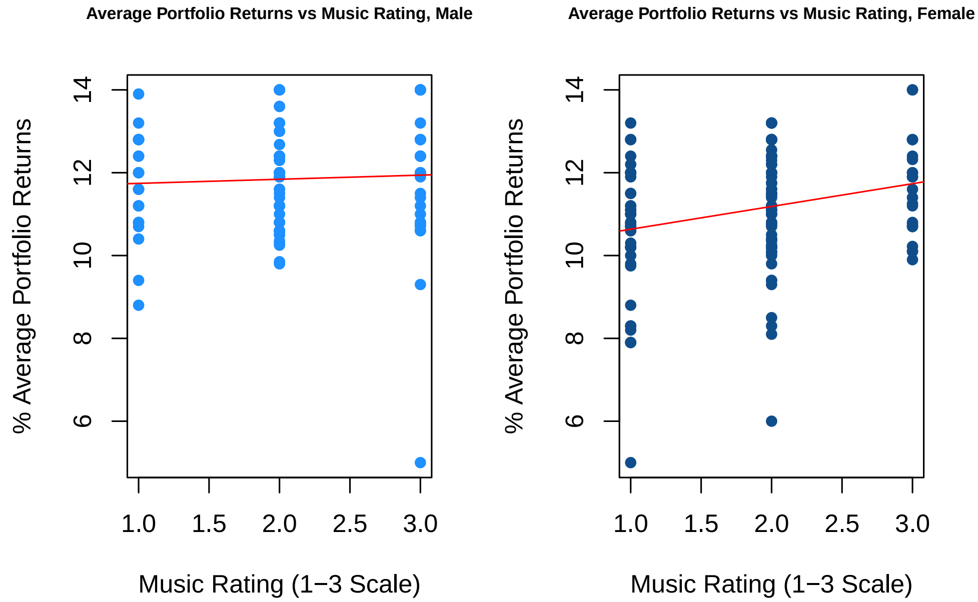


These scatterplots display the relationship between average lottery returns and mood change, one for males and the other for females. For males, the scatterplot shows average lottery returns ranging from around 6 to 13 across different mood change values from -2 to 3. There is no clear trend, with points scattered randomly across the range of mood changes. For females, the average lottery returns range from around 6 to 11.5. There is a distinct positive linear trend visible, with the line of best fit sloping upwards from left to right. As the mood change increases from around -4 to 2, the average lottery returns tend to increase correspondingly. The spread of points is slightly tighter for females compared to males, indicating potentially less variability in lottery returns for a given mood change level among females. Overall, the difference in the distributions between males and females implies that the relationship between mood change and lottery returns may be influenced by gender. While mood change does not seem to affect lottery returns for males significantly, it appears to have a positive impact for females, with better moods leading to higher returns.

These scatterplots display the relationship between average portfolio returns and mood change, one for males and the other for females. For males, the scatterplot shows average portfolio returns ranging from approximately 6 to 14 across different mood change values from -2 to 3. There is no clear trend or pattern visible, with the points scattered randomly across the range of mood changes. This suggests that mood change does not have a significant impact on portfolio returns for males. On the other hand, for females, the average portfolio returns range from around 6 to 12. There is a distinct positive linear trend visible, with the line of best fit sloping upwards from left to right. As the mood change increases from around -4 to 2, the average portfolio returns tend to increase correspondingly. This relationship appears to be relatively strong, indicating that more positive mood changes are associated with higher average portfolio returns for females. The spread of points is slightly tighter for females compared to males, suggesting potentially less variability in portfolio returns for a given mood change level among females. While the overall trend for females is positive, there is still some variation in the data points around the line of best fit, implying that mood change alone does not correlate with portfolio returns. Overall, while mood change does not seem to significantly impact portfolio returns for males based on this scatterplot, for females, more positive mood changes are associated with higher average portfolio returns in a linear fashion across the range of observed mood change values. The relationship between mood change and portfolio returns appears to be more pronounced and consistent for females compared to males.

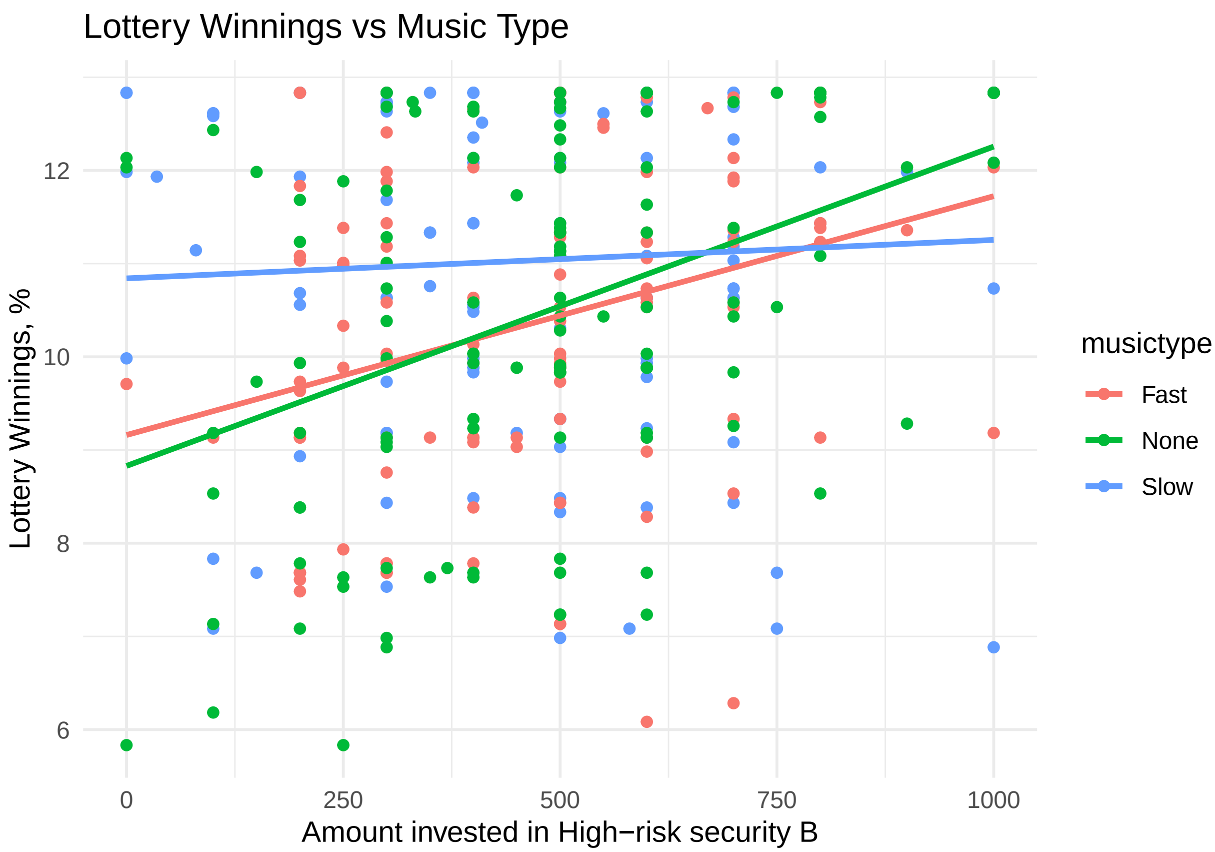


These scatterplots display the relationship between average lottery returns and music ratings on a 1-3 scale, one for males and the other for females. For males, the average lottery returns range from around 6 to 13 across different music rating values from 1.0 to 3.0. There is a positive linear trend visible, with the line of best fit sloping upwards from left to right. As the music rating increases from 1.0 to 3.0, the average lottery returns tend to increase correspondingly. This suggests that higher music ratings are associated with higher lottery returns for males.For females, the average lottery returns range from around 6 to 12.5. There is also a positive linear trend visible, with the line of best fit sloping upwards from left to right. As the music rating increases from 1.0 to around 2.5, the average lottery returns tend to increase. However, the relationship appears to be weaker for females compared to males, as the points are more scattered around the line of best fit. The spread of points is slightly tighter for females compared to males, suggesting potentially less variability in lottery returns for a given music rating level among females.While the overall trends are positive for both genders, there is still some variation in the data points around the lines of best fit, implying that music ratings alone may not fully explain the lottery returns, and other factors could also be at play. Overall, higher music ratings are associated with higher average lottery returns for both males and females, with the relationship appearing stronger and more consistent for males compared to females based on these scatterplots. However, the positive trend is present for both genders across the range of observed music rating values.



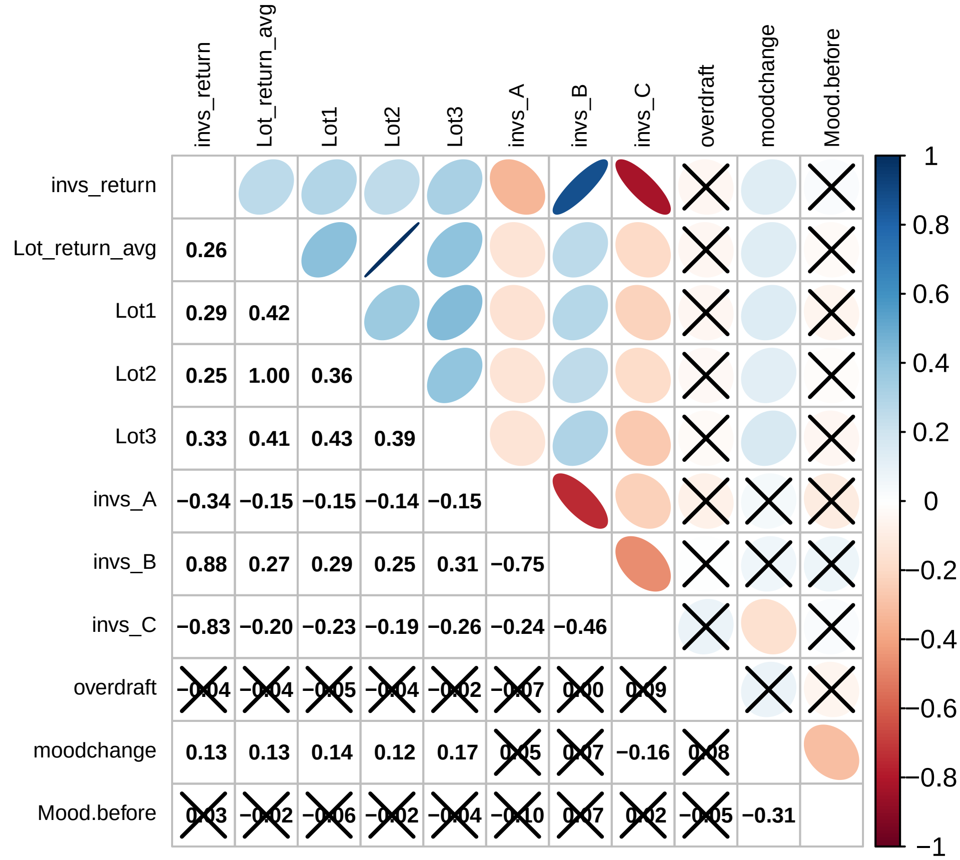
These scatterplots dispolay the relationship between average portfolio returns and music ratings on a 1-3 scale, one for males and the other for females. For males, the average portfolio returns range from around 6 to 14 across different music rating values from 1.0 to 3.0. There is no clear trend or pattern visible, with the points scattered randomly across the range of music ratings. This suggests that music ratings do not have a significant impact on portfolio returns for males. For females, the average portfolio returns range from around 6 to 12. There is a positive linear trend visible, with the line of best fit sloping upwards from left to right. As the music rating increases from 1.0 to 3.0, the average portfolio returns tend to increase correspondingly. This relationship appears to be relatively strong, indicating that higher music ratings are associated with higher average portfolio returns for females. The spread of points is slightly tighter for females compared to males, suggesting potentially less variability in portfolio returns for a given music rating level among females. While the overall trend for females is positive, there is still some variation in the data points around the line of best fit, implying that music ratings alone may not fully explain the portfolio returns, and other factors could also be at play. Overall, while music ratings do not seem to significantly impact portfolio returns for males based on this scatterplot, for females, higher music ratings are associated with higher average portfolio returns in a linear fashion across the range of observed music rating values. The relationship between music ratings and portfolio returns appears to be more pronounced and consistent for females compared to males.

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

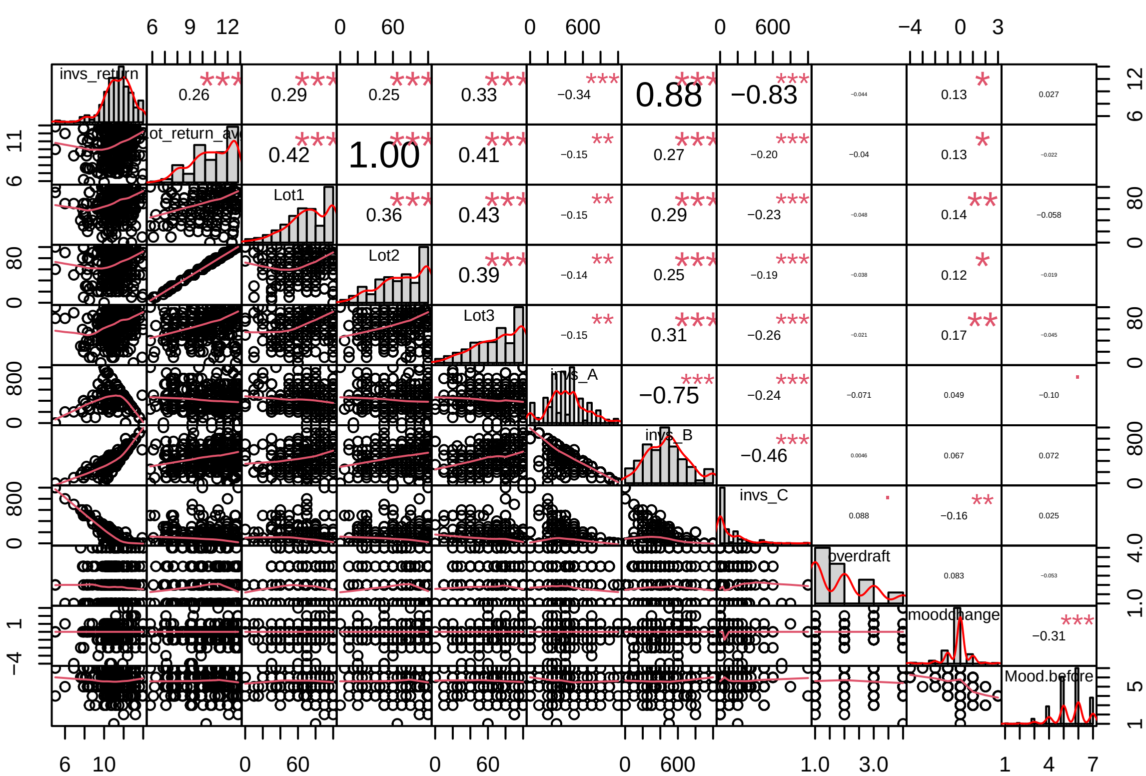


4.1 Correlations Plot

We ran these following plots to visually see the correlations and significance values.



4.2 Correlation Chart



The above two plots display the correlations between our continuous variables in our dataset. Correlations with no X's are significant correlations (or ones with asterisks). Focusing on the **investment portfolio return (invs_return)** and **average lottery return Lot_return_avg** variables, we see many significant correlations with other variables. Average lottery return had a very strong positive correlation (1.00) with Lot2, the amount invested in a high risk, high return lottery, and also had a significant weak positive correlation with moodchange (0.13), indicating how much a participant's mood improved. The investment portfolio return had a strong positive correlation (0.88) with invs_B, a high-risk high-return security, a strong negative correlation (-0.83) with invs_c, a security that was risk-free but had low returns, and also had a weak positive correlation (0.13) with moodchange. Interestingly, the frequency people's bank account was overdrawn and mood before the investment exercise did not significantly impact their investment portfolio or lottery returns.

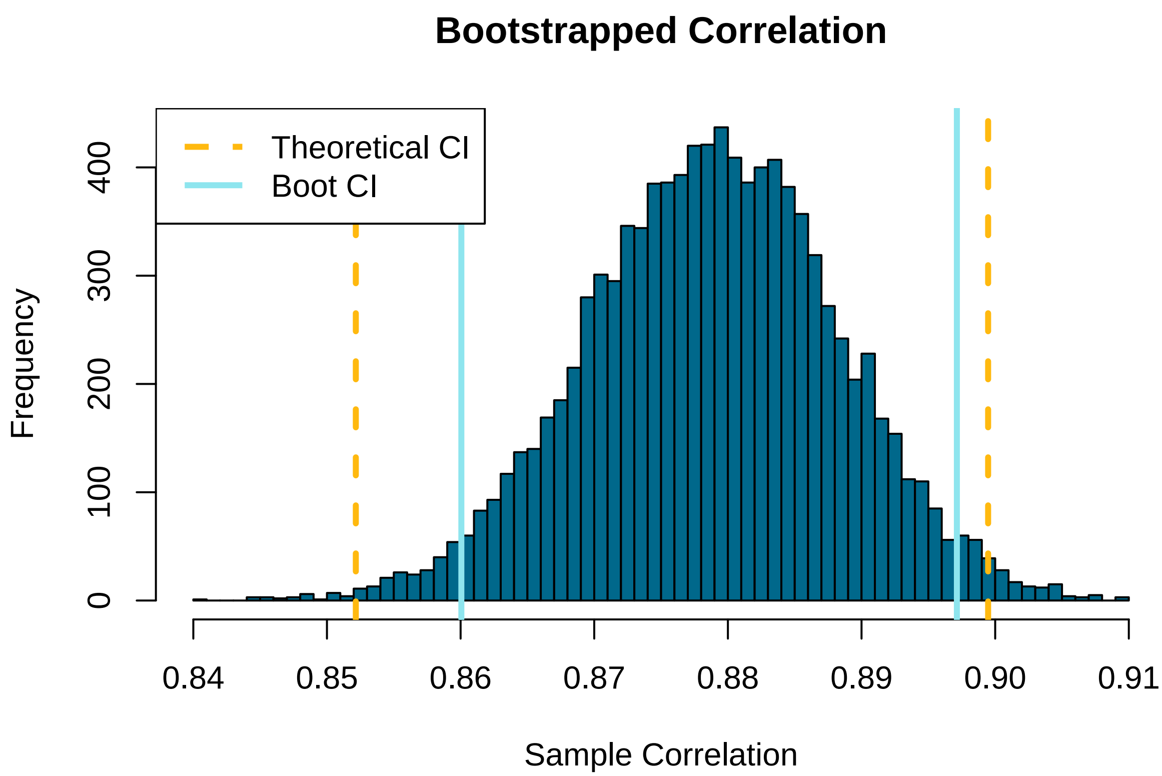
Overall, this suggests that people who invested 1% more in the riskier lotteries / securities had 0.88% and 1% higher expected investment portfolio and average lottery returns, respectively. Furthermore, people who had got happier by 1 more point on the happiness scale had a 0.13% higher return in both lotteries and portfolios. Looking at the left side of the correlation chart, these correlations look more or less linear, which makes them appropriate for linear regression later on.

Is riskiness truly as strong of a predictor of return as it appears? We ran a bootstrap to find out!

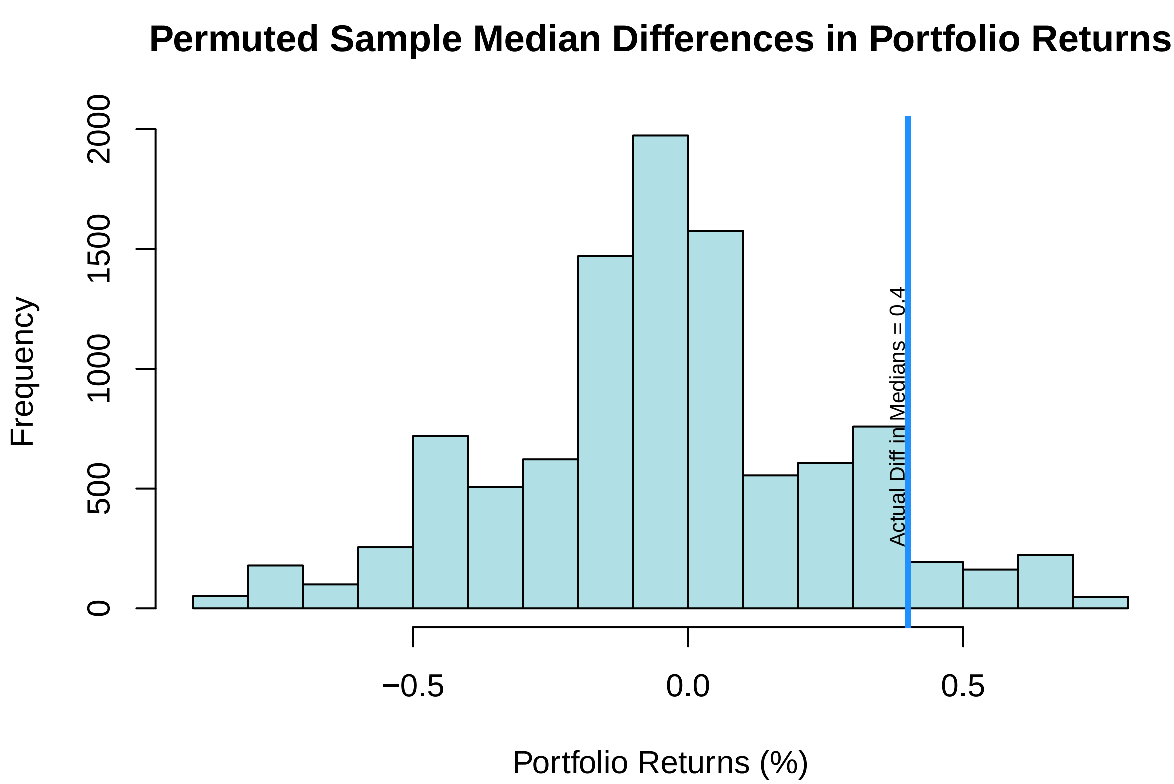
4.3 Bootstrap Test

```
##
##  Pearson's product-moment correlation
##
## data:  data$invs_return and data$invs_B
## t = 35.034, df = 365, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.8521586 0.8994712
## sample estimates:
##      cor
## 0.877941
```

```
##      2.5%     97.5%
## 0.8600567 0.8971333
```

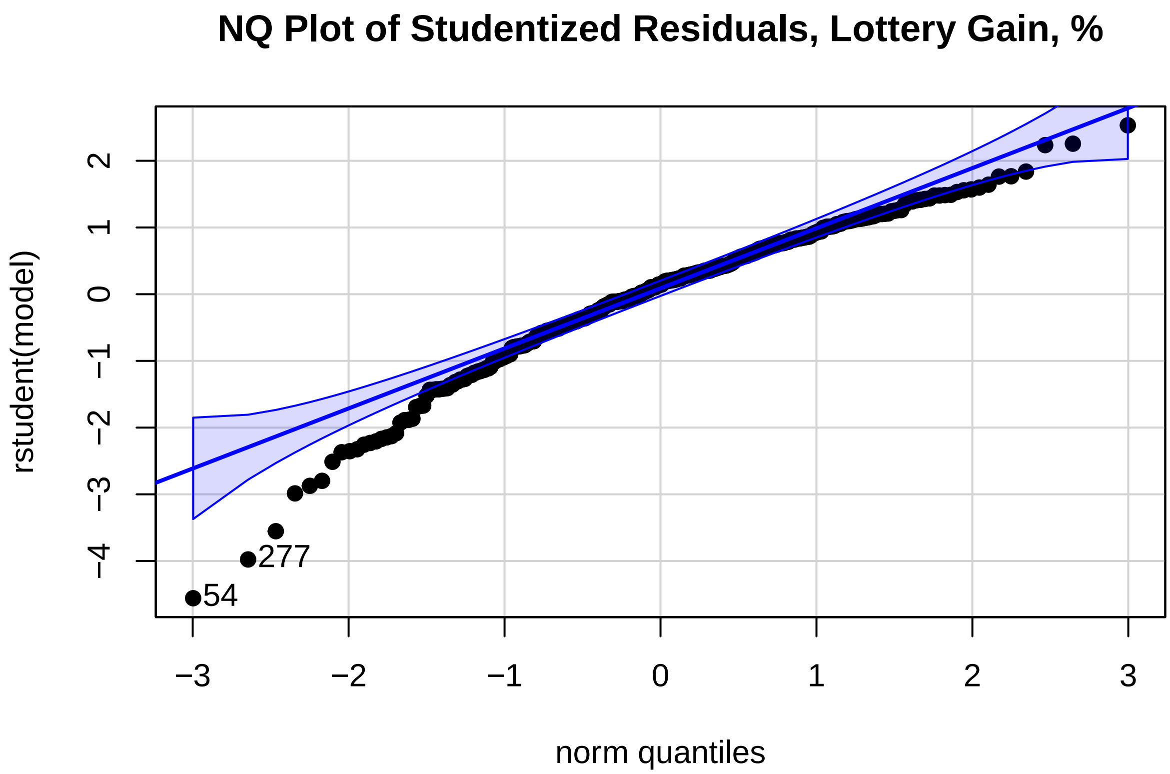


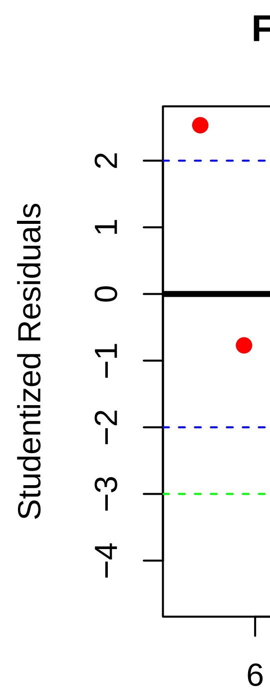
Permutation Test




```
## [1] 0.1967
```

4.3.1 Multiple Regression





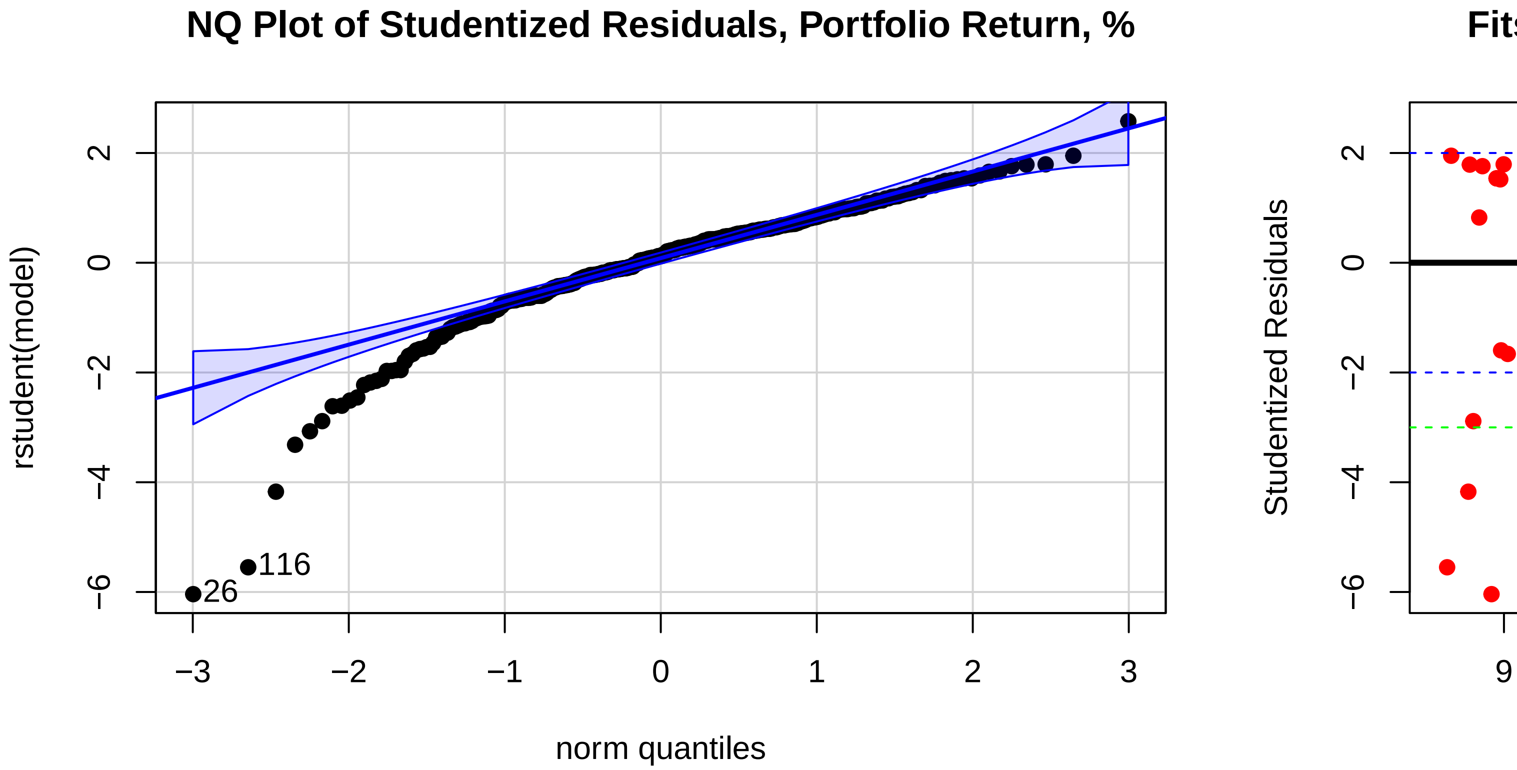

```
##           1           2           3           4           5           6
## -0.24034955  0.22963430  0.32488583 -0.10364195  0.17335171  0.20824820
##           7           8           9          10          11          12
##  0.10397159  0.61512895 -0.10364195  0.32622664  0.81122493 -1.40884392
##          13          14          15          16          17          18
##  0.78080790  0.20357327 -0.10364195  0.68314387 -0.45995006 -1.20928338
##          19          20          21          22          23          24
## -0.17156844 -2.35370840  0.10397159 -0.36428722 -2.32458962  0.58608987
##          25          26          27          28          29          30
##  0.70475116  1.07926843  1.13915269  0.78690097  0.31621795  0.68363253
##          31          32          33          34          35          36
##  0.29686760  0.53524161 -0.43312382  0.10397159  0.42134425  0.10397159
##          37          38          39          40          41          42
##  0.73188865 -0.52973463  0.10397159 -0.36345192 -1.31742256 -0.27010267
##          43          44          45          46          47          48
##  0.75068757  0.39312157  0.75068757  0.39312157  1.20560822  0.92071323
##          49          50          51          52          53          54
##  0.86154641  0.53408368 -1.41397570 -1.67731666 -1.17262249 -4.55764259
##          55          56          57          58          59          60
##  0.99382371  0.32488583  0.99382371 -1.11165496 -1.11130535 -0.79489616
##          61          62          63          64          65          66
## -0.13133513  0.20337107  0.51385716  0.03260847  0.44638004  1.08775271
##          67          68          69          70          71          72
##  0.05986538 -0.53547054  0.91537816  0.29817848 -1.67061599  0.02227029
##          73          74          75          76          77          78
##  1.05748952 -0.48787733 -0.58227892  0.81911947  0.68740494 -0.41307882
##          79          80          81          82          83          84
## -1.15743110 -0.29455267 -2.87339009 -1.41984694 -0.18291627  0.12818036
##          85          86          87          88          89          90
```

```
## -0.42059695 -0.57873054 -0.34635479  0.29989835  0.34356803 -0.53190430
##          91          92          93          94          95          96
## -0.11365217  0.27875304 -0.29143382 -0.19796771 -1.13401445 -1.22604712
##          97          98          99         100         101         102
## -0.07904320 -0.11365217  0.27875304 -0.54750992  0.06151449  1.13101776
##         103         104         105         106         107         108
##  0.33557642  0.20105490  1.01266740 -0.95202802  0.22561824 -0.70508728
##         109         110         111         112         113         114
## -0.03486380 -0.70508728 -1.26902901  1.34472073  1.24983022  0.81870003
##         115         116         117         118         119         120
##  0.84820349  1.40723734  0.81870003  0.84820349  1.01194405  0.93728775
##         121         122         123         124         125         126
##  1.15269855  0.27709892  0.27709892 -0.46670492  1.20978208 -0.76471885
##         127         128         129         130         131         132
##  0.35296820  1.09501382 -1.15336555  1.20192431 -1.03023479  0.30716449
##         133         134         135         136         137         138
##  0.18977448  0.02458807 -0.76963342  1.20192431  0.25982768 -0.28055843
##         139         140         141         142         143         144
## -0.42157321  0.73055123  0.35296820  0.54531103  0.29323888  0.43573266
##         145         146         147         148         149         150
##  0.90046793 -0.02742892 -0.37574136  0.76782980  1.42733791 -2.14732571
##         151         152         153         154         155         156
##  0.83506041  0.72878524 -0.78434533  0.40560716 -1.88806841 -0.66552311
##         157         158         159         160         161         162
##  0.84063239 -0.43525612  0.16568306 -0.08638906 -0.45786896  0.35474648
##         163         164         165         166         167         168
## -0.78025487  0.83506041  0.35296820 -0.11453216 -0.51808929 -0.11453216
##         169         170         171         172         173         174
## -0.51808929  0.83506041 -2.51248106 -0.33133612 -0.60312685 -0.90078382
##         175         176         177         178         179         180
## -1.69349824 -0.07829287 -0.57494880  0.78367235 -1.92448848  2.25603225
##         181         182         183         184         185         186
##  0.73370123 -0.92484715  0.93702495  1.18880446  0.45828811 -0.90402989
##         187         188         189         190         191         192
##  0.00110246 -2.08484429 -1.36470072 -0.02695922  0.28628708  1.59856508
##         193         194         195         196         197         198
##  0.68706894  0.56407372 -1.43444082 -0.02558468  1.57082471  0.04932995
##         199         200         201         202         203         204
##  0.66730243  0.14427448  0.04384232  1.76292256 -2.12814725 -0.80644955
##         205         206         207         208         209         210
## -0.02462636  0.11584680  0.39940233  0.47170260 -0.78359088  0.14361164
##         211         212         213         214         215         216
## -0.40554705  0.21216464 -2.79822538 -0.24117511 -0.09958443  1.02443590
##         217         218         219         220         221         222
##  0.76429607  1.64167805  0.56772320 -1.88357246 -0.16059368 -0.03867770
##         223         224         225         226         227         228
## -0.97346550 -0.40984188  1.83797339  1.10352176  1.11388893  0.45370284
##         229         230         231         232         233         234
##  1.16327018 -1.86664366 -0.97822012 -0.62641733  1.12614760 -0.15300398
##         235         236         237         238         239         240
## -0.15227765  0.87583414 -0.79215487  1.25972510  1.48553748  0.23259038
##         241         242         243         244         245         246
## -1.21373020 -0.02283870  0.76525262 -0.54123292  1.16971609  1.24226859
##         247         248         249         250         251         252
## -0.37134827 -0.10803662  0.21720946  1.55739224  0.38056534 -0.28253655
##         253         254         255         256         257         258
## -0.56304342  1.53120862  0.62071902  1.05082244 -0.08111468  0.02970204
##         259         260         261         262         263         264
##  0.76525262  0.38056534  0.86214458  0.60247640  0.21770439 -1.27718162
```

```
##         265         266         267         268         269         270 
## -1.13838333  0.48299872  0.14366977 -0.51300029  1.41449838  0.67746823 
##         271         272         273         274         275         276 
##  0.59828408  1.47822907 -0.06580317  0.62337212  2.53137004 -1.01600984 
##         277         278         279         280         281         282 
## -3.97647766  0.32689252  0.71538584  0.43075795  0.20109790  1.43627761 
##         283         284         285         286         287         288 
## -2.16895704  0.57267095 -0.48204900 -3.55320669 -0.06673095 -1.09111622 
##         289         290         291         292         293         294 
##  1.01644397  0.51637447 -2.98630392  1.12863767 -0.92502036  0.25295441 
##         295         296         297         298         299         300 
##  0.41814562 -0.46855293  0.56067444  0.57267095  0.38056534 -0.70771275 
##         301         302         303         304         305         306 
## -0.74873153  1.26064334  0.57267095 -0.37233972  0.94181884 -0.77077124 
##         307         308         309         310         311         312 
##  0.21200272 -1.43408732  1.14521906  1.48990169  1.76763158 -0.71516790 
##         313         314         315         316         317         318 
##  0.38054192 -1.27997401 -0.99626138  0.64548744  0.19509015  0.14351739 
##         319         320         321         322         323         324 
## -0.73347057 -0.25702338 -2.25640279 -2.36950635 -1.30582143  0.40989103 
##         325         326         327         328         329         330 
##  1.01142243 -1.18119853 -0.36004091  2.23430339  0.35315551  0.71259422 
##         331         332         333         334         335         336 
## -0.02799552 -0.11594416 -0.07195927  0.73640942  0.42676775  0.07698333 
##         337         338         339         340         341         342 
## -1.35458224 -1.52274463  0.42622423  0.23944862  0.28803550  0.85598718 
##         343         344         345         346         347         348 
##  0.35339363 -1.42617362 -0.45106183 -2.23043083  1.47922546 -0.11432273 
##         349         350         351         352         353         354 
## -0.61609898  0.23984584 -0.28527088  0.59576246 -0.38210133 -0.32970365 
##         355         356         357         358         359         360 
## -0.18285939 -0.51977298  1.38624062 -2.20679262 -0.94860873  1.04828579 
##         361         362         363         364         365         366 
##  1.09625031 -0.23478910 -0.54848146 -0.23478910  1.39008342 -1.42617362 
##         367 
##  0.31568523
```

```
## 
## Call:
## lm(formula = Lot_return_avg ~ musictype + moodchange + gender + 
##     Lot2 + invs_B, data = data)
## 
## Residuals:
##      Min       1Q   Median       3Q      Max 
## -0.46585 -0.05444  0.01511  0.07327  0.25944 
## 
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)    
## (Intercept)    5.535e+00  1.992e-02 277.857  < 2e-16 ***
## musictypeNone -2.909e-03  1.366e-02  -0.213  0.83143    
## musictypeSlow  2.603e-02  1.386e-02   1.878  0.06119 .  
## moodchange     7.201e-03  6.617e-03   1.088  0.27720    
## genderMale     3.456e-02  1.133e-02   3.052  0.00244 ** 
## Lot2           7.125e-02  2.298e-04 310.041  < 2e-16 ***
## invs_B         1.016e-04  2.487e-05   4.083 5.49e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 0.1058 on 360 degrees of freedom
```

```
## Multiple R-squared:  0.9967, Adjusted R-squared:  0.9966
## F-statistic: 1.807e+04 on 6 and 360 DF,  p-value: < 2.2e-16
```




```
##           1           2           3           4           5           6
##  0.038339535  0.497216409 -0.100787346  0.307187271 -0.450428887 -1.799152085
##           7           8           9          10          11          12
## -0.601810828  0.549897782  0.307187271 -0.740608684  0.987607479 -0.867160114
##          13          14          15          16          17          18
##  0.919935558  0.487787276 -0.419645356  0.701637326 -0.406768371  0.035621578
##          19          20          21          22          23          24
##  0.919935558  1.205161490 -0.601810828  0.484395736 -0.698889449  0.484395736
##          25          26          27          28          29          30
##  0.497216409 -6.039165454 -0.495953568 -0.426152904  0.921147055  0.754005674
##          31          32          33          34          35          36
## -0.165520895 -0.139044959  0.332674919 -0.601810828 -0.612053110 -0.601810828
##          37          38          39          40          41          42
##  0.810625557  0.115930077 -0.601810828 -0.860518169 -0.242879373 -0.259919973
##          43          44          45          46          47          48
##  0.090852308  0.051266253  0.090852308  0.051266253  1.023546611  0.727132772
##          49          50          51          52          53          54
##  1.456914096 -0.410749225  0.320629323  0.550932970  0.706633096 -0.100787346
##          55          56          57          58          59          60
##  0.096136551 -0.100787346  0.096136551 -0.962192412 -0.369712122  1.269917329
##          61          62          63          64          65          66
## -0.786215157 -0.179624659  0.577384826  0.622287513  0.426350969  0.067000973
##          67          68          69          70          71          72
##  0.287420761  0.274115640  0.833054112  0.618340647 -1.573323032 -4.172355079
##          73          74          75          76          77          78
##  0.824310029  0.682457368  0.059117527  0.668546195  0.667441461  1.102021134
##          79          80          81          82          83          84
```

```
## -0.444225065 -0.365579708  0.425590205  0.425590205  1.590055854  0.438876725
##           85           86           87           88           89           90
##  1.759698321 -0.688133364 -0.108996747  1.130808869 -0.786215157  1.088455388
##           91           92           93           94           95           96
## -1.956190781 -0.423432500 -1.971649949  0.604283250  0.314509468 -0.543848997
##           97           98           99          100          101          102
##  0.618194769 -1.956190781 -0.423432500  0.725751629 -1.080493967  0.334560423
##          103          104          105          106          107          108
##  1.287648432 -0.296437734 -0.405933543 -1.661979820  1.793327219  0.399607436
##          109          110          111          112          113          114
##  0.884941934  0.399607436 -0.136246985  1.788137546  0.347523204  0.616130479
##          115          116          117          118          119          120
##  0.681945516 -5.549506446  0.616130479  0.681945516  0.373933582  0.628788508
##          121          122          123          124          125          126
##  0.858189844 -3.071162231 -0.123140821 -0.249763455  1.490786518 -0.136384264
##          127          128          129          130          131          132
## -0.639213548 -0.456335403 -0.201800489 -0.206653673 -1.109041512 -0.175756439
##          133          134          135          136          137          138
## -1.562895259  0.257455392 -0.974293029  0.525878227  0.784202663  0.896576995
##          139          140          141          142          143          144
##  1.197377001  0.448203988 -0.639213548 -0.202403486  1.168081073  0.977845810
##          145          146          147          148          149          150
##  0.583728311 -0.393368799 -0.725009993  0.296735783  1.134728420  0.487066983
##          151          152          153          154          155          156
##  0.448370815 -0.120419576 -0.573635316 -0.635849083  0.311042977 -0.560974355
##          157          158          159          160          161          162
## -1.274597233  0.606142965 -0.686748672 -0.074917835  0.226473038 -0.221530049
##          163          164          165          166          167          168
## -1.122613219  0.448370815 -0.639213548  1.323239698  0.977845810  1.323239698
##          169          170          171          172          173          174
##  0.977845810 -0.279881815  2.578485248  0.270631016  0.288811501  0.079699772
##          175          176          177          178          179          180
## -1.971980975  0.146485263  0.402236310  0.337333359  0.959752217 -0.389531659
##          181          182          183          184          185          186
##  0.476420644 -2.152743205  0.694815127  0.706657873  0.278280557 -0.212842356
##          187          188          189          190          191          192
## -0.995892342  1.397745129 -0.140299943 -1.061268226 -0.186071691  1.258033342
##          193          194          195          196          197          198
##  0.121027387  0.516366706  0.540364691 -0.632176622  0.429109772 -0.159704752
##          199          200          201          202          203          204
## -1.080336886  0.698235904 -0.428173123  0.861805206 -2.182147154 -2.116473473
##          205          206          207          208          209          210
## -0.580037726 -0.095275580  0.963000228 -0.108442208  0.528146900  0.646730713
##          211          212          213          214          215          216
## -1.173924243 -0.605541483  1.084835165  0.592645427  0.402236310  0.224652266
##          217          218          219          220          221          222
## -0.133589925  0.121027387 -0.492172940  1.503343185 -1.537359251 -0.399940943
##          223          224          225          226          227          228
##  1.949833848  0.771228642 -0.172847362 -2.454424745 -1.287047355  0.298882125
##          229          230          231          232          233          234
## -0.969628349 -0.844987507 -0.332615085  0.541790432 -0.115044439 -0.275649775
##          235          236          237          238          239          240
## -0.222905986  0.146485263  0.172694535  0.480203444 -0.318591702  0.237558589
##          241          242          243          244          245          246
##  0.121027387  0.235733132  0.208972656  0.274968220  0.604124143  0.261518919
##          247          248          249          250          251          252
##  0.970166450 -1.357259599  0.604124143  0.708284282 -0.661259229 -0.007644507
##          253          254          255          256          257          258
##  0.477845527 -2.605723544 -0.116046011  0.591331138  0.582954481  0.438448051
```

```
##          259          260          261          262          263          264 
## -0.518677260 -0.661259229  0.425716753 -0.019273418 -0.097093001 -0.684634743 
##          265          266          267          268          269          270 
##  0.208972656 -0.032443548 -1.463705781 -3.317034186  0.898857630  1.131095403 
##          271          272          273          274          275          276 
## -0.376740866  1.538154422  0.274968220  0.451367927  1.519507666 -0.979419211 
##          277          278          279          280          281          282 
##  0.425716753 -0.982853665  0.080426728 -0.708637838 -1.532628253  0.694581851 
##          283          284          285          286          287          288 
##  0.873481927 -0.224584735  0.228484507 -1.143971269  0.221959455 -0.688774297 
##          289          290          291          292          293          294 
##  0.646553718  1.538154422 -0.215161838  1.015779975 -0.076341085  0.995008423 
##          295          296          297          298          299          300 
## -0.248233255  0.643038467  1.174225440 -0.224584735 -0.661259229  0.425716753 
##          301          302          303          304          305          306 
## -1.346088068  1.411107274 -0.224584735 -1.697481529  0.537839752 -2.227635562 
##          307          308          309          310          311          312 
##  0.762068311  0.532450698  0.291087042 -1.012122491 -2.615242590 -2.511330064 
##          313          314          315          316          317          318 
##  0.583220718  0.080820871 -0.873818446 -0.466266343  1.235742772 -0.117571012 
##          319          320          321          322          323          324 
##  0.355711664 -1.103187008  1.656893053 -0.069752783 -0.641135619 -0.079620731 
##          325          326          327          328          329          330 
## -0.656351718 -1.163156595  0.545810161  1.036610930 -0.298169017 -0.311683910 
##          331          332          333          334          335          336 
## -0.079936051  0.839755402  0.380060470  0.356701785  0.512996049 -0.182019240 
##          337          338          339          340          341          342 
##  0.558911167  1.401704018  0.124161309  0.046194017  0.206956942 -0.005544464 
##          343          344          345          346          347          348 
##  1.080774966  0.799833782  0.651570061 -1.204658520  0.428334335  1.662852638 
##          349          350          351          352          353          354 
##  0.993129116  0.098807992  1.021327749  0.812748346  0.748748306 -0.030116240 
##          355          356          357          358          359          360 
##  0.047755821 -0.259644485  0.531913366  0.150424276 -1.018995210 -2.886310082 
##          361          362          363          364          365          366 
##  0.557889180  0.826049080 -1.596748968 -1.357581769  1.212456259  0.072463879 
##          367 
## -0.885528866 
```

```
## 
## Call:
## lm(formula = invs_return ~ musictype + moodchange + gender + 
##     Lot2 + invs_B, data = data)
## 
## Residuals:
##     Min      1Q  Median      3Q     Max 
## -3.9226 -0.3061  0.0833  0.4223  1.7406 
## 
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)    
## (Intercept)    8.6178521  0.1301410  66.219  < 2e-16 ***
## musictypeNone  0.0153152  0.0892299   0.172  0.86382    
## musictypeSlow -0.0251738  0.0905510  -0.278  0.78117    
## moodchange     0.1044576  0.0432314   2.416  0.01618 *  
## genderMale     0.2392109  0.0739878   3.233  0.00134 ** 
## Lot2           0.0009073  0.0015014   0.604  0.54604    
## invs_B         0.0054888  0.0001625  33.777  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 0.6914 on 360 degrees of freedom
## Multiple R-squared:  0.7829, Adjusted R-squared:  0.7793
## F-statistic: 216.4 on 6 and 360 DF,  p-value: < 2.2e-16
```

```
##   (Intercept) musictypeNone musictypeSlow moodchange genderMale Lot2 invs_B
## 1        TRUE         FALSE         FALSE      FALSE      FALSE TRUE  FALSE
## 2        TRUE         FALSE         FALSE      FALSE      FALSE TRUE   TRUE
## 3        TRUE         FALSE         FALSE      FALSE       TRUE TRUE   TRUE
## 4        TRUE         FALSE          TRUE      FALSE       TRUE TRUE   TRUE
```

Using the predictor matrix generated by the best subsets regression, the best predictors of high lottery return are Lot2 and invs_B, the two riskier assets participants could have invested in/bet on, since they appear as TRUE in more subsets. Gender and Musictype are also moderately good predictors. Moodchange seems to be the least significant predictor, so we will leave it out of the final model.

```
## [1] 4
```

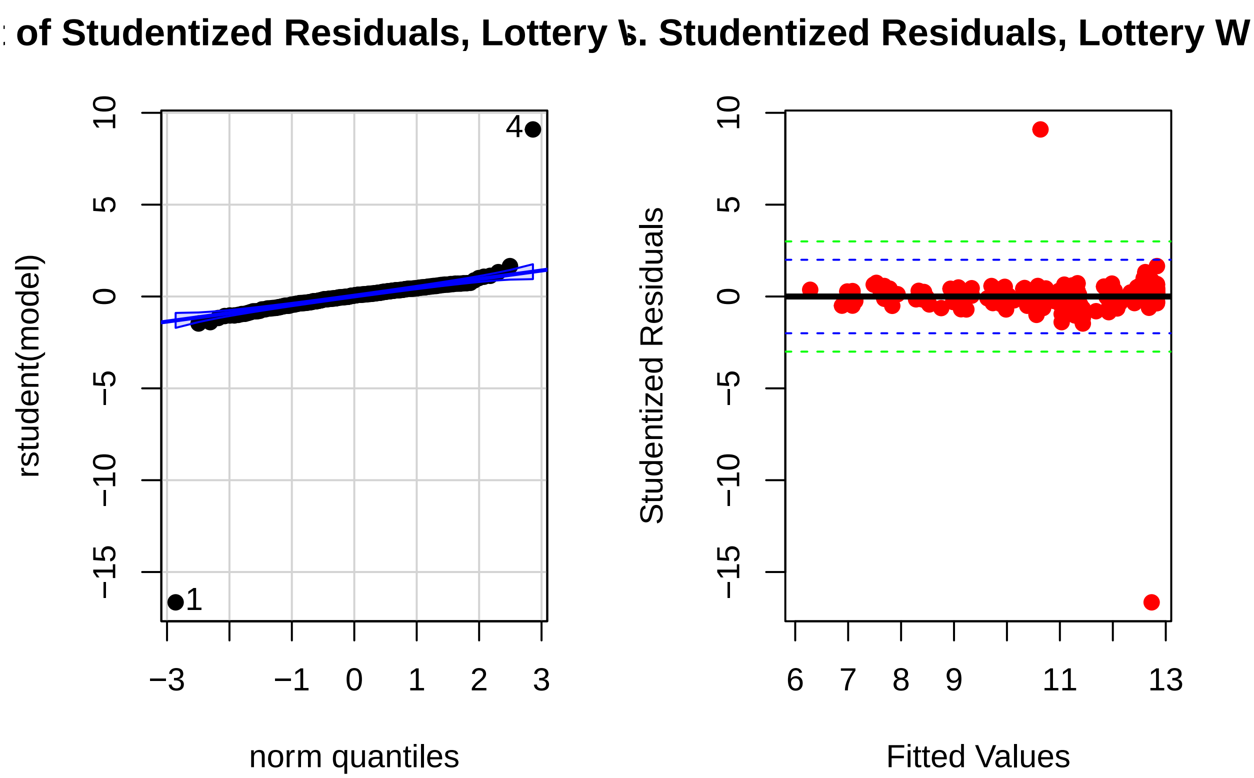
```
##   (Intercept) musictypeNone musictypeSlow    moodchange    genderMale
##          TRUE         FALSE          TRUE         FALSE          TRUE
##          Lot2        invs_B
##          TRUE          TRUE
```

The above shows the best variables predicting average lottery return, which are Lot2, Invs_B, genderMale and musictypeSlow. These are the variables we will use in the final model.

```
## Warning in summary.lm(bestmodel): essentially perfect fit: summary may be
## unreliable
```

```
##
## Call:
## lm(formula = Lot_return_avg ~ ., data = datanew)
##
## Residuals:
##        Min         1Q     Median         3Q        Max
## -1.894e-14 -4.768e-16  9.240e-17  5.792e-16  1.346e-14
##
## Coefficients: (3 not defined because of singularities)
##                         Estimate Std. Error    t value Pr(>|t|)
## (Intercept)            4.667e+00  1.027e-14  4.546e+14   <2e-16 ***
## serial                -1.660e-18  1.035e-17 -1.600e-01   0.8728
## Mood.before           -1.420e-16  1.562e-16 -9.090e-01   0.3644
## Lot2                   7.000e-02  5.372e-18  1.303e+16   <2e-16 ***
## Lot3                   3.107e-18  5.811e-18  5.350e-01   0.5934
## invs_A                 2.651e-18  9.581e-18  2.770e-01   0.7823
## invs_B                 5.454e-18  1.717e-17  3.180e-01   0.7511
## Age                    2.791e-17  4.561e-17  6.120e-01   0.5412
## Marital                1.383e-16  5.787e-16  2.390e-01   0.8114
## overdraft             -1.018e-16  1.217e-16 -8.370e-01   0.4037
## Mood.after             8.436e-18  1.438e-16  5.900e-02   0.9533
## music_rec             -3.707e-16  2.022e-16 -1.834e+00   0.0681 .
## music_effect           7.066e-17  9.911e-17  7.130e-01   0.4767
## hearingproblems       -4.479e-16  8.389e-16 -5.340e-01   0.5939
## genderMale             3.368e-16  7.980e-16  4.220e-01   0.6734
## musictypeSlow         -9.665e-17  1.381e-15 -7.000e-02   0.9443
## maritalstatusMarried -6.721e-17  6.092e-16 -1.100e-01   0.9123
## maritalstatusSingle          NA         NA         NA       NA
```

```
## Lot1_return          6.667e-02  8.525e-17  7.821e+14   <2e-16 ***
## Lot3_return                 NA         NA         NA       NA
## invs_return         -5.955e-16  1.900e-15 -3.130e-01   0.7543
## Lot_avg                     NA         NA         NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.775e-15 on 220 degrees of freedom
##   (128 observations deleted due to missingness)
## Multiple R-squared:      1,  Adjusted R-squared:      1
## F-statistic: 1.31e+31 on 18 and 220 DF,  p-value: < 2.2e-16
```




```
## Warning in sqrt((n - p - sr^2)/(n - p - 1)): NaNs produced

##             1            2            3            4            5
## -16.649584011 -0.649380537  1.656114402  9.095289557  0.094568766
##             6            7            8            9           10
##   0.472440240  0.430716923  0.278541465 -0.376316194 -0.046068924
##            11           12           13           14           15
##   0.498062254 -0.443085900  0.172267052 -0.703159285 -0.543158253
##            16           17           18           19           20
##   0.395436342  0.046260041 -0.052928904  0.517949208  0.423005927
##            21           22           23           24           25
##  -0.361557844  0.676280552  0.598876306  0.627432670 -0.327439487
##            26           27           28           29           30
##   0.197635277 -0.499743587  0.053242585 -0.129157697 -0.303706744
##            31           32           33           34           35
##   0.192751905 -1.031320335  0.551507991  0.094872665  0.201882360
##            36           37           38           39           40
##  -0.001424184  0.268616622  0.725457630 -0.085399854 -0.999988464
```

```
##          41          42          43          44          45
## -0.233769705  0.294483270  0.160667620 -0.358983782  0.111282843
##          46          47          48          49          50
## -0.253377439  0.743213182 -1.168243555 -0.507161512  0.438397409
##          51          52          53          54          55
## -0.112929579  0.144127510  0.140373267  0.219783616  0.096481386
##          56          57          58          59          60
##  0.165614679  0.046338658 -0.018654753  0.221537303 -0.021105402
##          61          62          63          64          65
##  0.001399519 -0.052271485 -0.294684669  0.875184960 -0.033382668
##          66          67          68          69          70
## -0.624658177 -0.333282159 -0.648756327  0.425981151 -0.496591520
##          71          72          73          74          75
##  0.106953371  0.702751463  0.138945929 -0.169105668  0.272621450
##          76          77          78          79          80
## -0.050166260  0.416662111  0.385992526 -0.942236410 -0.347118945
##          81          82          83          84          85
## -1.395788035 -0.807124258 -0.251216563  0.116991321 -0.582881669
##          86          87          88          89          90
## -0.534027617  0.142632339 -0.261544158  0.340637477  0.119014107
##          91          92          93          94          95
##  1.327192003  0.722159002  0.572561868 -0.032934453  0.328120385
##          96          97          98          99         100
##  0.309880887  0.246456413  1.127089313  0.700283567  1.076763292
##         101         102         103         104         105
## -0.012179993 -0.062100514 -0.799204491  0.183741714  0.368521123
##         106         107         108         109         110
##  1.001951850  0.042023700 -0.583731955 -0.319052159 -0.613137742
##         111         112         113         114         115
## -0.150023789  0.678095465 -0.651211725  0.495356345  0.402255690
##         116         117         118         119         120
## -0.703142295  0.351730933  0.251720420 -0.506810211 -0.354472346
##         121         122         123         124         125
## -0.898299271 -0.197177810 -0.137222755 -0.019176395  0.164845127
##         126         127         128         129         130
## -0.400956410 -0.254233234  0.419888664  0.602157674  0.287982273
##         131         132         133         134         135
## -0.207177749 -0.433953033  0.139930829  0.314620025 -0.238949985
##         136         137         138         139         140
##  0.280671399  0.246898556  0.438879898  0.408475949 -0.433326316
##         141         142         143         144         145
##  0.353841653  0.085164165  0.112788852  0.427863084  0.651552983
##         146         147         148         149         150
##  0.103909612 -0.460858330  0.195459415 -0.114773924 -0.502732491
##         151         152         153         154         155
##  0.011031573 -0.852823163  0.492000185 -0.432462764 -0.153793698
##         156         157         158         159         160
## -0.145089182 -0.217031613 -0.692025153  0.116315290 -0.621173935
##         161         162         163         164         165
## -0.629217694  0.306570052 -0.134262708  0.107689824 -0.077626416
##         166         167         168         169         170
## -0.130913389 -0.110057765 -0.024235927 -0.121326538  0.158860524
##         171         172         173         174         175
##          NaN  0.085756261  0.367594218  0.701372861  0.541985155
##         176         177         178         179         180
##  0.626305907 -0.105140158  0.158056663  0.463356958  0.125301733
##         181         182         183         184         185
## -0.349428704 -0.102998448  0.503026402  0.526711543 -0.043963000
##         186         187         188         190         191
```

```
##  -0.033902596  -0.332474252   0.646751029  -0.262038810   0.320915567
##           192           193           194           195           196
##  -0.807022142   0.076504541   0.177268853  -0.298296653  -1.030060769
##           197           198           199           200           201
##   0.064427412   0.028317910   0.251608210  -0.097562974   0.217613888
##           202           203           204           205           206
##   0.451198543  -0.955094358   0.348156053   0.072544148   0.096320816
##           207           208           209           210           211
##   0.058692010  -0.390579851  -0.559139727   0.442385043  -0.022871710
##           212           213           214           215           216
##  -0.181306368  -0.357800288   0.544753616   0.574453393  -0.145530476
##           217           218           219           220           221
##   0.341401913  -0.107356225   0.332449154  -0.096293693   0.484155188
##           222           223           224           225           227
##  -0.051502003   0.571503375   0.293912775   0.042084498  -1.470856242
##           228           230           231           232           233
##  -0.403730725   0.646674972   0.200455553   0.340971325  -0.776525046
##           234           235           236           237           238
##  -0.147588790   0.135051253  -0.313483019   0.261219718  -1.063256900
##           239           240           241           242
##  -0.257424531  -0.212535112  -0.357905254   0.361593736
```

Mention that there are outliers.

4.3.2 Ancova

```
## Anova Table (Type III tests)
##
## Response: Lot_return_avg
##              Sum Sq  Df    F value    Pr(>F)
## (Intercept)  864.61   1 77204.6701 < 2.2e-16 ***
## musictype      0.06   2     2.6578  0.071477 .
## moodchange     0.01   1     1.1843  0.277203
## gender         0.10   1     9.3125  0.002445 **
## Lot2        1076.51   1 96125.5330 < 2.2e-16 ***
## invs_B         0.19   1    16.6692 5.486e-05 ***
## Residuals      4.03 360
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##   (Intercept) musictypeNone musictypeSlow    moodchange    genderMale
##  5.5350429467 -0.0029094681  0.0260302916  0.0072014801  0.0345603304
##          Lot2        invs_B
##  0.0712525990  0.0001015552
```

```
##
##  Welch Two Sample t-test
##
## data:  data$Lot_avg by data$gender
## t = -4.2324, df = 346.21, p-value = 2.965e-05
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##  -13.457198  -3.239405
## sample estimates:
## mean in group Female   mean in group Male
##             67.70238             76.05068
```

```
##
##  Welch Two Sample t-test
##
## data:  data$invs_A by data$gender
## t = -0.76257, df = 323.95, p-value = 0.4463
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##  -75.07057  40.93081
## sample estimates:
## mean in group Female   mean in group Male
##             407.3980             424.4678

##
##  Welch Two Sample t-test
##
## data:  data$invs_B by data$gender
## t = -2.1098, df = 338.22, p-value = 0.03561
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##  -114.12425   11.67151
## sample estimates:
## mean in group Female   mean in group Male
##             459.6684             510.8947

##
##  Welch Two Sample t-test
##
## data:  data$invs_C by data$gender
## t = 4.2336, df = 359.11, p-value = 2.924e-05
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##   26.06704 108.18627
## sample estimates:
## mean in group Female   mean in group Male
##            132.93367             65.80702

##
##  Welch Two Sample t-test
##
## data:  data$invs_num by data$gender
## t = 5.1571, df = 354.51, p-value = 4.179e-07
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##  0.1604618 0.4841856
## sample estimates:
## mean in group Female   mean in group Male
##             2.515306             2.192982

##
##  Welch Two Sample t-test
##
## data:  data$Lot_return_avg by data$gender
## t = -2.8214, df = 347.5, p-value = 0.005056
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##  -1.02959204 -0.04402593
## sample estimates:
## mean in group Female   mean in group Male
##             10.39451             10.93132
```

```
##
##  Welch Two Sample t-test
##
## data:  data$invs_return by data$gender
## t = -3.6676, df = 364.11, p-value = 0.0002813
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##  -0.9421203 -0.1623490
## sample estimates:
## mean in group Female   mean in group Male
##             11.17401             11.72624
```

```
##
##  Welch Two Sample t-test
##
## data:  data$moodchange by data$gender
## t = -2.7208, df = 362.8, p-value = 0.006826
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##  -0.46947030 -0.01161337
## sample estimates:
## mean in group Female   mean in group Male
##         -0.234693878          0.005847953
```

```
##
##  Welch Two Sample t-test
##
## data:  data$music_like by data$gender
## t = -2.4437, df = 228.64, p-value = 0.01529
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##  -0.45820789  0.01397805
## sample estimates:
## mean in group Female   mean in group Male
##             1.842105             2.064220
```

```
##
##  Welch Two Sample t-test
##
## data:  data$Lot1_return by data$gender
## t = -4.1431, df = 353.01, p-value = 4.292e-05
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##  -1.2260544 -0.2828518
## sample estimates:
## mean in group Female   mean in group Male
##             15.08546             15.83991
```

```
##
##  Welch Two Sample t-test
##
## data:  data$Lot2_return by data$gender
## t = -2.2451, df = 347.56, p-value = 0.02539
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##  -1.05565188  0.07530995
## sample estimates:
## mean in group Female   mean in group Male
##             6.055969             6.546140
```

```
##
##  Welch Two Sample t-test
##
## data:  data$Lot3_return by data$gender
## t = -1.175, df = 348.39, p-value = 0.2408
## alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
## 99 percent confidence interval:
##  -1.1721023  0.4404965
## sample estimates:
## mean in group Female   mean in group Male
##             10.04209             10.40789
```