Assignment

2022-06-25

Contents

0.1 Importing Data

```
data = data <- readxl::read_excel("Dataset for regressions.xlsx")
```

```
data = data %>% clean_names()
data %>% glimpse()
```

```
## Rows: 153
## Columns: 17
## $ car_1               <dbl> -0.0309, 0.0193, 0.1554, -0.0200, 0.0818, 0.0365, ~
## $ car_2               <dbl> -0.0391, 0.0512, 0.2336, -0.0104, -0.0858, 0.0939,~
## $ covid_19            <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,~
## $ sector              <chr> "Real Estate", "Real Estate", "Energy and Power", ~
## $ diversification     <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,~
## $ cross_border        <dbl> 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 0,~
## $ cash                <chr> "1", "1", "1", "0", "0", "1", "1", "1", "1", "0", ~
## $ shares              <chr> "0", "0", "0", "1", "1", "0", "1", "1", "0", "1", ~
## $ both                <dbl> 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0,~
## $ deal_value          <chr> "3640", "433.11559999999997", "1500", "18.89999999~
## $ ebitda_pos_2020     <dbl> 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 1, 0, 0, 1,~
## $ revenue_pos_2020    <dbl> 0, 1, 1, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 1, 0, 1,~
## $ p_e_dummy           <chr> "0", "1", "1", "1", "0", "0", "1", "1", "1", "0", ~
## $ size_revenue        <dbl> 7631.00, 908.30, 13388.00, 328.78, 88.31, 23882.29~
```

```
## $ size_category       <chr> "large", "medium", "large", "medium", "medium", "l~
## $ size_relative       <chr> "0.477001703577512 76", "0.4768441124919629", "0.11~
## $ dummy_relative_size <chr> "1", "1", "0", "0", "0", "1", "n.d", "1", "0", "1"~
```

Below shows how to identfy null values which had been recorded as ND

```
data$p_e_dummy[which(data$p_e_dummy == "n.d.")] <- NA
data$shares[which(data$shares == "n.d.")] <- NA
```

converrting character columns to factor/categorical data types

```
cols = c("covid_19", "sector", "cross_border", "diversification", "cash", "both", "dummy_relative_size"

data %<>% mutate_at(cols, factor)
```

convert some character data types to numeric

```
cols_num = c("deal_value", "size_relative")

data %<>% mutate_at(cols_num, as.numeric)
```

```
## Warning in mask$eval_all_mutate(quo): NAs introduced by coercion

## Warning in mask$eval_all_mutate(quo): NAs introduced by coercion
```

```
kable(str(data))
```

```
## tibble [153 x 17] (S3: tbl_df/tbl/data.frame)
##  $ car_1              : num [1:153] -0.0309 0.0193 0.1554 -0.02 0.0818 ...
##  $ car_2              : num [1:153] -0.0391 0.0512 0.2336 -0.0104 -0.0858 ...
##  $ covid_19           : Factor w/ 2 levels "0","1": 1 1 1 1 1 1 1 1 1 1 ...
##  $ sector             : Factor w/ 12 levels "Consumer Products and Services",..: 9 9 2 4 5 6 5 5 6 1
##  $ diversification    : Factor w/ 2 levels "0","1": 1 1 1 1 1 1 1 1 1 1 ...
##  $ cross_border       : Factor w/ 2 levels "0","1": 2 2 2 1 2 2 2 1 2 2 ...
##  $ cash               : Factor w/ 3 levels "0","1","n.d.": 2 2 2 1 1 2 2 2 2 1 ...
##  $ shares             : Factor w/ 2 levels "0","1": 1 1 1 2 2 1 2 2 1 2 ...
##  $ both               : Factor w/ 2 levels "0","1": 1 1 1 1 1 1 2 2 1 1 ...
##  $ deal_value         : num [1:153] 3640 433.1 1500 18.9 13.7 ...
##  $ ebitda_pos_2020    : num [1:153] 0 0 0 0 0 0 0 1 0 1 ...
##  $ revenue_pos_2020   : num [1:153] 0 1 1 1 0 0 0 1 0 1 ...
##  $ p_e_dummy          : Factor w/ 2 levels "0","1": 1 2 2 2 1 1 2 2 2 1 ...
##  $ size_revenue       : num [1:153] 7631 908.3 13388 328.8 88.3 ...
##  $ size_category      : Factor w/ 3 levels "large","medium",..: 1 2 1 2 2 1 2 2 1 1 ...
##  $ size_relative      : num [1:153] 0.477 0.4768 0.112 0.0575 0.1548 ...
##  $ dummy_relative_size: Factor w/ 3 levels "0","1","n.d": 2 2 1 1 1 2 3 2 1 2 ...
```

|| || || || ## Convert Size_revenue to a log

```
data$size_revenue = log(data$size_revenue)
```

0.1.1 Plotting the Distribution of Log Size Revenue

```
p1 = ggplot(data = data, aes(x = size_revenue)) +
 geom_density(fill = "blue")+theme_light()+labs(title = "Distribtion of Revenue Size", caption = "Assig

p2 = ggplot(data = data, aes(x = size_revenue)) +
 geom_density(fill = "blue")+facet_wrap(~covid_19)+theme_light()+labs(title = "Distribtion of Revenue Si

ggarrange(p1, p2)
```

Distribution remains the same before and after covid

0.2 Data Exploratory Analysis

```
library(skimr)
skim(data)
```

Table 1: Data summary

Name	data
Number of rows	153
Number of columns	17

Column type frequency:

Table 1: Data summary

factor	10
numeric	7
Group variables	None

Variable type: factor

skim_variable	n_missing	complete_rate	ordered	n_unique	top_counts
covid_19	0	1.00	FALSE	2	1: 83, 0: 70
sector	0	1.00	FALSE	12	Hig: 42, Ind: 22, Hea: 15, Inv: 13
diversification	0	1.00	FALSE	2	0: 121, 1: 32
cross_border	0	1.00	FALSE	2	0: 99, 1: 54
cash	0	1.00	FALSE	3	1: 83, n.d: 54, 0: 16
shares	54	0.65	FALSE	2	0: 55, 1: 44
both	0	1.00	FALSE	2	0: 125, 1: 28
p_e_dummy	14	0.91	FALSE	2	1: 79, 0: 60
size_category	0	1.00	FALSE	3	med: 78, lar: 68, sma: 7
dummy_relative_size	0	1.00	FALSE	3	n.d: 64, 1: 45, 0: 44

Variable type: numeric

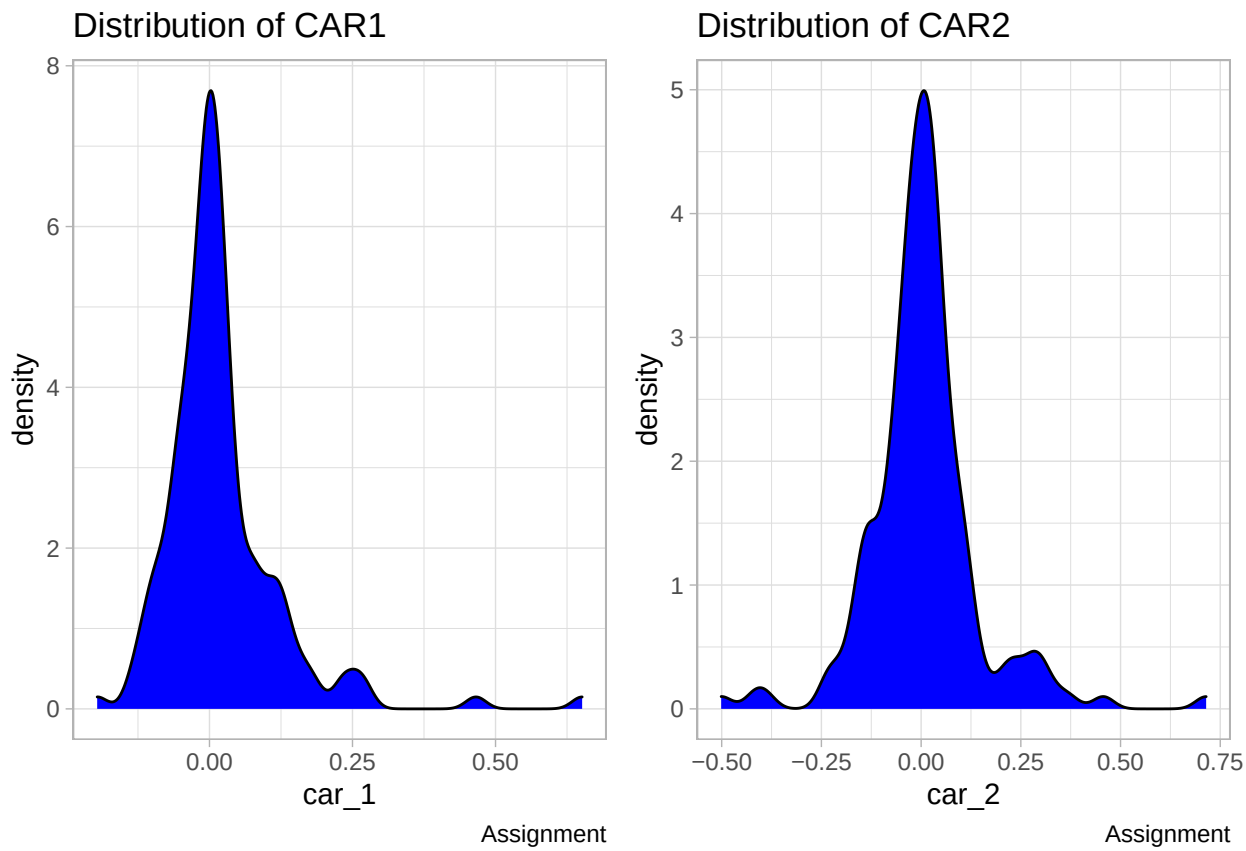
skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
car_1	0	1.00	0.02	0.10	-0.20	-0.03	0.00	0.04	0.65	
car_2	0	1.00	0.01	0.14	-0.50	-0.06	0.00	0.05	0.71	
deal_value	64	0.58	1809.95	6730.18	0.83	18.90	95.00	730.00	53510.62	
ebitda_pos_2020	0	1.00	0.45	0.50	0.00	0.00	0.00	1.00	1.00	
revenue_pos_2020	0	1.00	0.58	0.50	0.00	0.00	1.00	1.00	1.00	
size_revenue	0	1.00	6.81	2.87	-0.69	4.42	6.26	9.28	12.37	
size_relative	64	0.58	1.70	5.20	0.00	0.02	0.17	0.88	37.46	

0.2.1 Plotting Distribution of the CAR Variables

```
p1 = ggplot(data = data, aes(x = car_1)) +
 geom_density(fill = "blue") + theme_light()+labs(title = "Distribution of CAR1", caption = 'Assignment


p2 = ggplot(data = data, aes(x = car_2)) +
 geom_density(fill = "blue") + theme_light()+labs(title = "Distribution of CAR2", caption = 'Assignment

ggarrange(p1, p2)
```



From the density plots above:Note that the distribution is almost Gaussian because most of the data is evenly distributed around the median, however, we note that it has a small left tail and a long right tail. The CAR2 variable has a normal distribution with almost equal length tails.

0.3 Correlation Analysis of the various variables

```
library(corrr)
```

0.3.0.1 Correlation

```
##
## Attaching package: 'corrr'

## The following object is masked from 'package:skimr':
##
##     focus
```

```
library(dplyr, warn.conflicts = FALSE)

data_cor = data %>%
    select_if(is.numeric) %>%
    correlate()
```

```
##
## Correlation method: 'pearson'
## Missing treated using: 'pairwise.complete.obs'
```

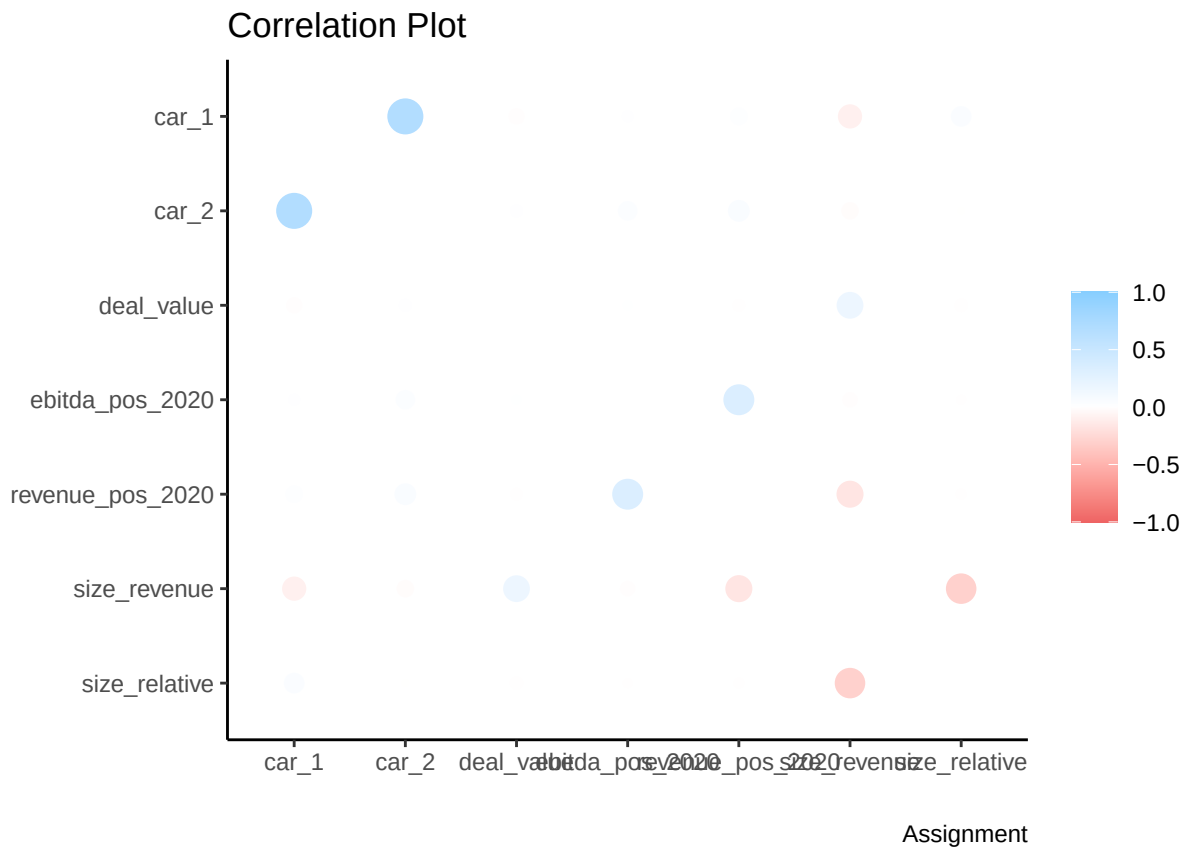
```
kable(data_cor)
```

term	car_1	car_2	deal_value	ebitda_pos_2020	revenue_pos_2020	size_revenue	size_relative
car_1	NA	0.6803	-0.0657	0.0192	0.0874	-0.2352	0.1473
car_2	0.6803	NA	0.0283	0.1239	0.1714	-0.0873	-0.0032
deal_value	-0.0657	0.0283	NA	0.0088	-0.0249	0.3129	-0.0328
ebitda_pos_2020	0.0192	0.1239	0.0088	NA	0.4601	-0.0562	-0.0080
revenue_pos_2020	0.0874	0.1714	-0.0249	0.4601	NA	-0.3205	-0.0128
size_revenue	-0.2352	-0.0873	0.3129	-0.0562	-0.3205	NA	-0.4442
size_relative	0.1473	-0.0032	-0.0328	-0.0080	-0.0128	-0.4442	NA

```
rplot(data_cor)+labs(title = 'Correlation Plot', caption = 'Assignment')
```

0.3.0.1.1 Correlation Plot

```
## Don't know how to automatically pick scale for object of type noquote. Defaulting to continuous.
```



Covariance : Strength of Relationship between Variables

```
data_cov = data %>%
    select_if(is.numeric) %>%
    colpair_map(stats::cov) %>%
  stretch()
kable(data_cov)
```

x	y	r
car_1	car_1	NA
car_1	car_2	0.0096
car_1	deal_value	NA
car_1	ebitda_pos_2020	0.0010
car_1	revenue_pos_2020	0.0044
car_1	size_revenue	-0.0681
car_1	size_relative	NA
car_2	car_1	0.0096
car_2	car_2	NA
car_2	deal_value	NA
car_2	ebitda_pos_2020	0.0087
car_2	revenue_pos_2020	0.0119
car_2	size_revenue	-0.0352
car_2	size_relative	NA
deal_value	car_1	NA
deal_value	car_2	NA

x	y	r
deal_value	deal_value	NA
deal_value	ebitda_pos_2020	NA
deal_value	revenue_pos_2020	NA
deal_value	size_revenue	NA
deal_value	size_relative	NA
ebitda_pos_2020	car_1	0.0010
ebitda_pos_2020	car_2	0.0087
ebitda_pos_2020	deal_value	NA
ebitda_pos_2020	ebitda_pos_2020	NA
ebitda_pos_2020	revenue_pos_2020	0.1139
ebitda_pos_2020	size_revenue	-0.0806
ebitda_pos_2020	size_relative	NA
revenue_pos_2020	car_1	0.0044
revenue_pos_2020	car_2	0.0119
revenue_pos_2020	deal_value	NA
revenue_pos_2020	ebitda_pos_2020	0.1139
revenue_pos_2020	revenue_pos_2020	NA
revenue_pos_2020	size_revenue	-0.4566
revenue_pos_2020	size_relative	NA
size_revenue	car_1	-0.0681
size_revenue	car_2	-0.0352
size_revenue	deal_value	NA
size_revenue	ebitda_pos_2020	-0.0806
size_revenue	revenue_pos_2020	-0.4566
size_revenue	size_revenue	NA
size_revenue	size_relative	NA
size_relative	car_1	NA
size_relative	car_2	NA
size_relative	deal_value	NA
size_relative	ebitda_pos_2020	NA
size_relative	revenue_pos_2020	NA
size_relative	size_revenue	NA
size_relative	size_relative	NA

0.3.1 Assessing Siginificance of Relationship between numeric variables

```
calc_ttest_p_value <- function(vec_a, vec_b){
  t.test(vec_a, vec_b)$p.value
}
data_num = data %>% select_if(is.numeric)
dat_t = colpair_map(data_num, calc_ttest_p_value)
kable(dat_t)
```

term	car_1	car_2	deal_value	ebitda_pos_2020	revenue_pos_2020	size_revenue	size_relative
car_1	NA	0.3313	0.0129	0.0000	0.0000	0.0000	0.0031
car_2	0.3313	NA	0.0129	0.0000	0.0000	0.0000	0.0029
deal_value	0.0129	0.0129	NA	0.0130	0.0130	0.0133	0.0130
ebitda_pos_2020	0.0000	0.0000	0.0130	NA	0.0298	0.0000	0.0268
revenue_pos_2020	0.0000	0.0000	0.0130	0.0298	NA	0.0000	0.0456

term	car_1	car_2	deal_value	ebitda_pos_2020	revenue_pos_2020	size_revenue	size_relative
size_revenue	0.0000	0.0000	0.0133	0.0000	0.0000	NA	0.0000
size_relative	0.0031	0.0029	0.0130	0.0268	0.0456	0.0000	NA

At a 95% level of significance, all numeric variables have a statistically significant relationship with the CAR variable. However, CAR1 and CAR2, at the same level of significance, their relationship is not statistically significant.

T test was used to assess the relationship between numerical data, which was normally distributed as shown by the plots above.

0.3.1.1 Examining Statistical Significance of relationship between categorical Variables

There are a few different ways of finding the strength of the relationship between two categorical variables. One useful measure is called Cramer's V, which takes on values between 0 and 1 depending on how closely associated the variables are.

```
library(data.table)
```

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

```
## The following object is masked from 'package:DescTools':
##
##     %like%
```

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

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

```
data_cat <- data[,colnames(data)[grepl('factor|logical|character',sapply(data,class))],with=F]

library(rcompanion)

kable(colpair_map(data_cat, cramerV, digits = 2))
```

term	covid_19	sector	diversification	cross_border	cash	shares	both	p_e_dummy	size_category	dummy_relative_size
covid_19	NA	0.38	0.012	0.120	0.082	0.110	0.061	0.120	0.06	0.130
sector	0.380	NA	0.500	0.380	0.300	0.300	0.350	0.270	0.50	0.360
diversification	0.012	0.50	NA	0.250	0.500	0.023	0.120	0.110	0.22	0.330
cross_border	0.120	0.38	0.250	NA	0.520	0.250	0.031	0.120	0.15	0.360
cash	0.082	0.30	0.500	0.520	NA	0.280	0.430	0.072	0.16	0.400
shares	0.110	0.30	0.023	0.250	0.280	NA	0.560	0.066	0.26	0.160
both	0.061	0.35	0.120	0.031	0.430	0.560	NA	0.140	0.30	0.290
p_e_dummy	0.120	0.27	0.110	0.120	0.072	0.066	0.140	NA	0.15	0.072
size_category	0.060	0.50	0.220	0.150	0.160	0.260	0.300	0.150	NA	0.270

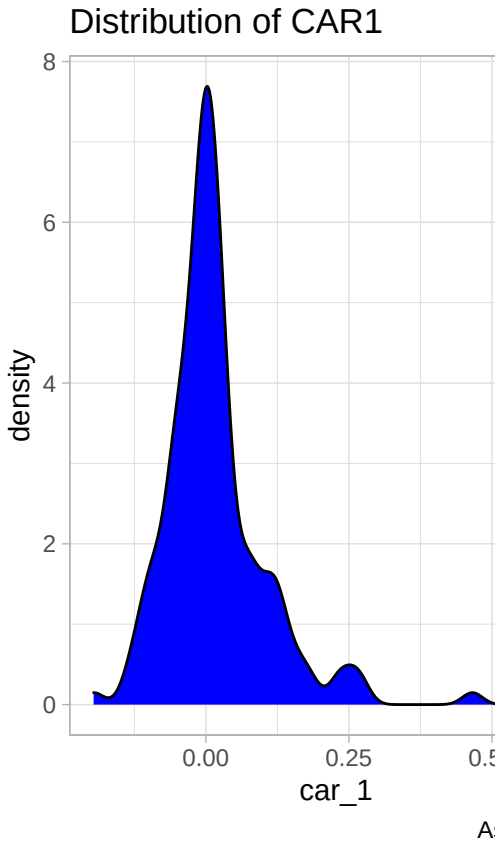
term	covid_19	sector	diversification	cross_border	cash	shares	both	p_e_dummy	size_category	dummy_relative_size
dummy_relative_size	0.130	0.36	0.330	0.360	0.400	0.160	0.290	0.072	0.27	NA

Note that Covid19 is most closely related with Sector than any other categorical variables.

```
p1 = ggplot(data = data, aes(x = car_1)) +
 geom_density(fill = "blue")+theme_light()+labs(title = 'Distribution of CAR1', caption = 'Assignment')

p2 = ggplot(data = data, aes(x = car_1)) +
 geom_density(fill = "blue")+facet_wrap(~covid_19)+theme_light()+labs(title = 'Distribution of CAR1', ca

ggarrange(p1, p2)
```

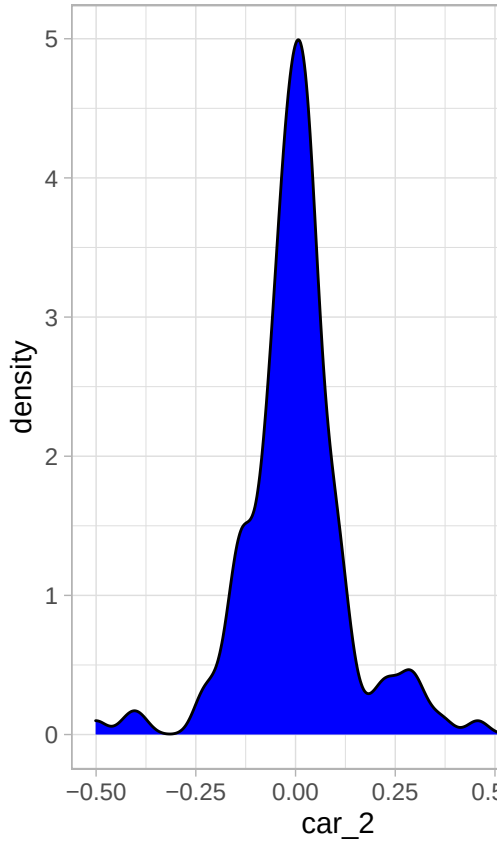


0.3.1.2 Distribution of Car1 generally and During and After Covid19

```
p1 = ggplot(data = data, aes(x = car_2)) +
 geom_density(fill = "blue")+theme_light()

p2 = ggplot(data = data, aes(x = car_2)) +
 geom_density(fill = "blue")+facet_wrap(~covid_19)+theme_light()
```

```
ggarrange(p1, p2)
```



0.3.1.3 Distribution of Car2 generally and During and After Covid19

Winsorizing Winsorization is a way to minimize the influence of outliers in your data by either: Assigning the outlier a lower weight, Changing the value so that it is close to other values in the set.

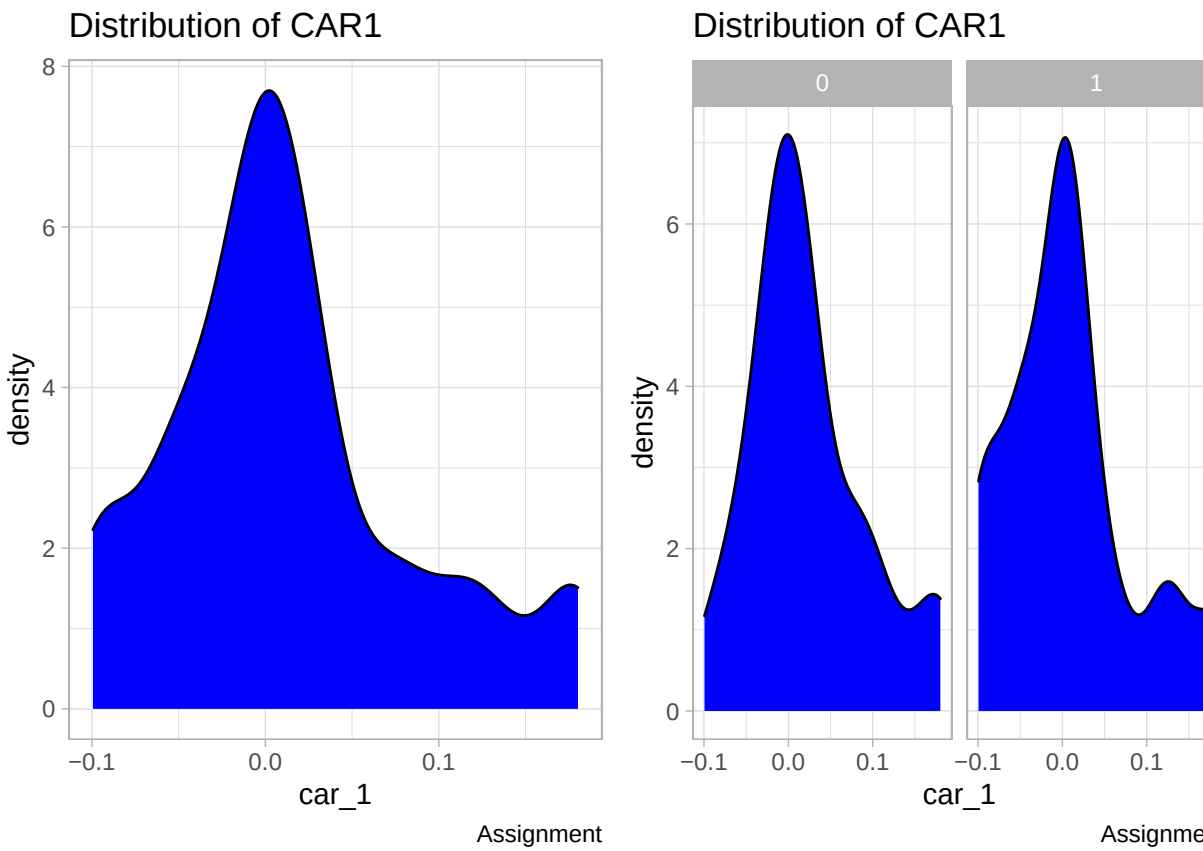
```
data$car_1 = Winsorize(data$car_1)
data$car_2 = Winsorize(data$car_2)
```

0.3.2 Examining the change in Distributions after Winsorizing

```
p1 = ggplot(data = data, aes(x = car_1)) +
 geom_density(fill = "blue")+theme_light()+labs(title = 'Distribution of CAR1', caption = 'Assignment')

p2 = ggplot(data = data, aes(x = car_1)) +
 geom_density(fill = "blue")+facet_wrap(~covid_19)+theme_light()+labs(title = 'Distribution of CAR1', ca

ggarrange(p1, p2)
```



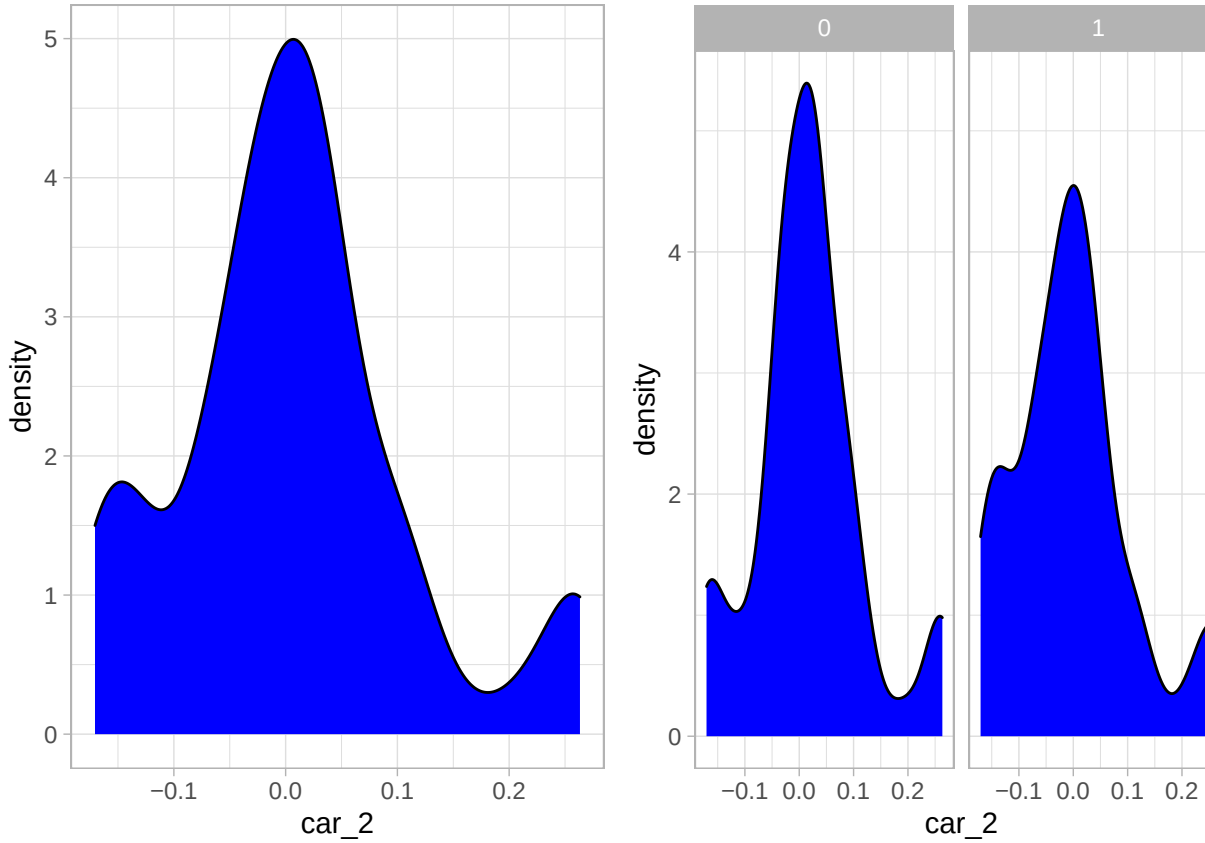
0.3.2.1 CAR 1

0.3.3 Examining the change in Distributions after Winsorizing

```
p1 = ggplot(data = data, aes(x = car_2)) +
 geom_density(fill = "blue")+theme_light()

p2 = ggplot(data = data, aes(x = car_2)) +
 geom_density(fill = "blue")+facet_wrap(~covid_19)+theme_light()

ggarrange(p1, p2)
```



0.3.3.1 CAR 2

Outliers negatively affect the accuracy of the model, hence the winsoriizing

0.4 HYPOTHESIS 1

COVID-19 has a positive impact on the cumulative abnormal return (CAR = dependent variable).

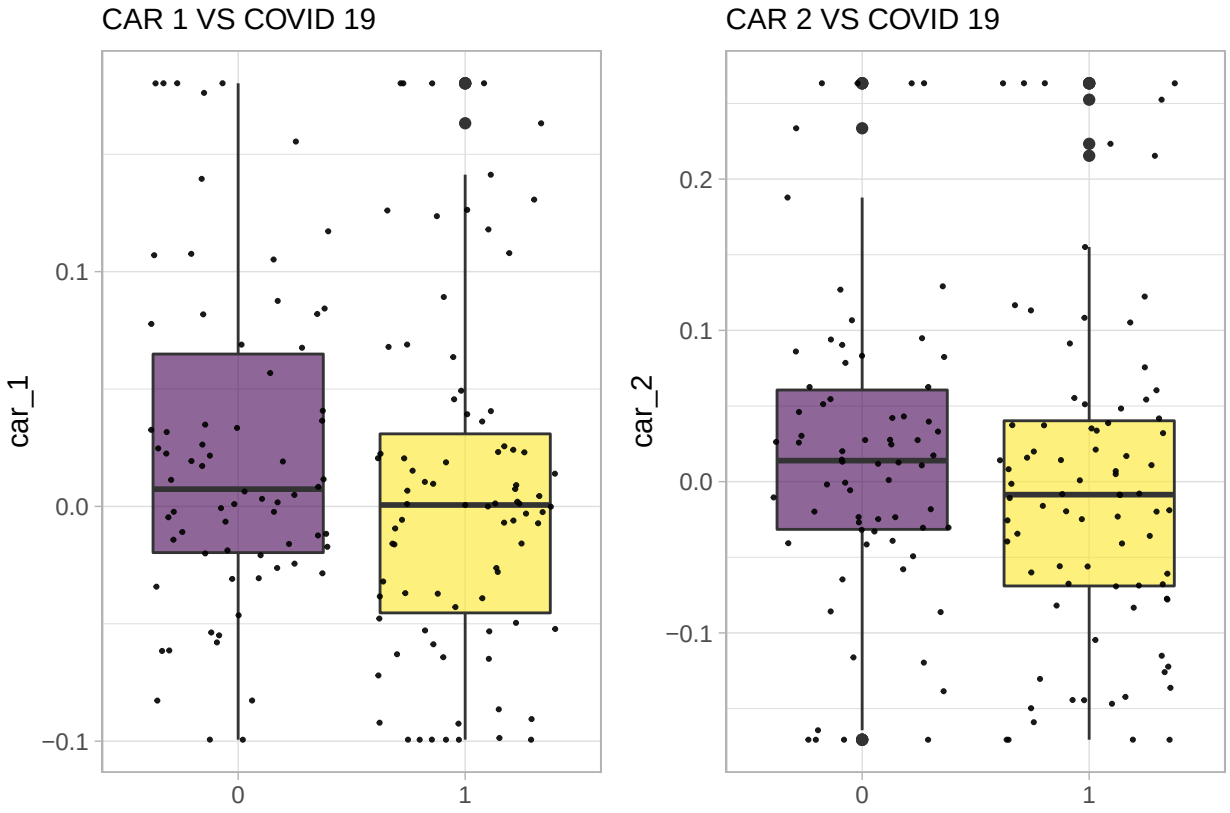
```
library(viridis)
```

```
## Loading required package: viridisLite
```

```
p1 = data %>%
  ggplot( aes(x=covid_19, y=car_1, fill=covid_19)) +
    geom_boxplot() +
    scale_fill_viridis(discrete = TRUE, alpha=0.6) +
    geom_jitter(color="black", size=0.4, alpha=0.9) +
    theme_light() +
    theme(
      legend.position="none",
      plot.title = element_text(size=11)
    ) +
    ggtitle("CAR 1 VS COVID 19") +
    xlab("")
p2 = data %>%
  ggplot( aes(x=covid_19, y=car_2, fill=covid_19)) +
    geom_boxplot() +
```

```
    scale_fill_viridis(discrete = TRUE, alpha=0.6) +
    geom_jitter(color="black", size=0.4, alpha=0.9) +
    theme_light() +
    theme(
      legend.position="none",
      plot.title = element_text(size=11)
    ) +
    ggtitle("CAR 2 VS COVID 19") +
    xlab("")

ggarrange(p1, p2)
```



Note that for CAR1 before covid-19 there were no otlers and median/ and mean was higher. CAR2 in both Covid-19 instances had outliers, CAR1 in covid times and after has outliers. Without winsorizing, the number of outliers would have been many.

```
# function to extract coefficients
extractCoefs <- function(x = mod1_CAR1){
  sum <- summary(x)

  df <- data.frame(sum$coefficients)
  names(df) <- c("Estimate", "Std_error", "T_value", "P_value")
  rownames(df)[1] <- "COVID190"
  df <- round(df, 3)
  df$Coefficient <- rownames(df)
  df$Dependent <- names(x$model)[1]
```

```
  rownames(df) <- NULL
  df <- df[, c("Dependent", "Coefficient", names(df)[-which(names(df) %in% c("Coefficient", "Dependent"))])
  return(df)
}
```

```
mod1_CAR1 <- lm(car_1 ~ covid_19, data = data)
summary(mod1_CAR1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.12238 -0.04531 -0.00861  0.03309  0.17401
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.02302    0.00858    2.68   0.0081 **
## covid_191   -0.01681    0.01165   -1.44   0.1512
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0718 on 151 degrees of freedom
## Multiple R-squared:  0.0136, Adjusted R-squared:  0.00706
## F-statistic: 2.08 on 1 and 151 DF,  p-value: 0.151
```

```
extractCoefs(mod1_CAR1)
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_1	COVID190	0.023	0.009	2.682	0.008
car_1	covid_191	-0.017	0.012	-1.443	0.151

```
mod1_CAR2 <- lm(car_2 ~ covid_19, data = data)
summary(mod1_CAR2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.18780 -0.05860 -0.00542  0.04400  0.26554
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.0172     0.0126    1.37     0.17
## covid_191    -0.0194     0.0171   -1.14     0.26
##
## Residual standard error: 0.105 on 151 degrees of freedom
```

```
## Multiple R-squared:  0.0085, Adjusted R-squared:  0.00194
## F-statistic: 1.29 on 1 and 151 DF,  p-value: 0.257
```

```
extractCoefs(mod1_CAR2)
```

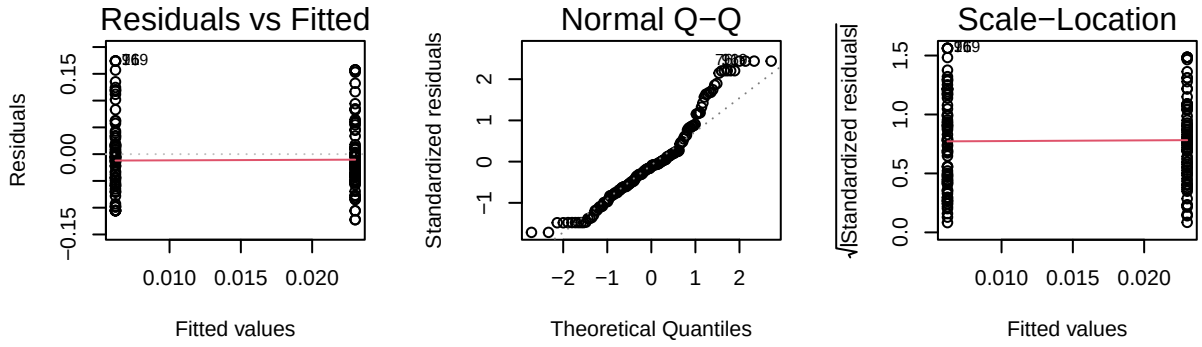
Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_2	COVID190	0.017	0.013	1.370	0.173
car_2	covid_191	-0.019	0.017	-1.138	0.257

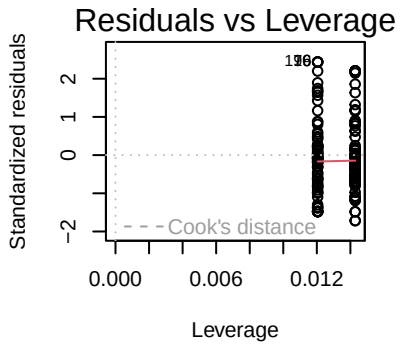
There is a marginally significant negative effect of COVID19 on CAR1, using a confidence interval of 80% ($p < 0.2$) but not in CAR2.On this significant level, the relationship between Covid 19 and Car 2 is not statistically significant, which means, car 2 was not impacted heavily or in a meaningful manner by Covid 19

Note that a linear model with a two level factor (with similar sample size per factor) is equivalent to a T-student test. Then, coefficients here show the mean of the response variable for group COVID19 = 0 and the effect of the second level. Then, for CAR1, the mean of the COVID 19 = 0 group is 0.023, while the effect of the second level (COVID 19 = 1) is -0.017. Then, the mean for the second level in CAR1 is 0.023 - 0.017= 0.06). The significance of COVID191 shows whether the difference is statistically significative.

0.4.1 Assumption One: Linearity of the Data

```
par(mfrow=c(2,3))
plot(mod1_CAR1)
```





In the above plot we can see that there is no clear pattern in the residual plot. This would indicate that we meet the assumption that there is a linear relationship between the predictors and the outcome variable.

0.4.2 Assumption Two: Predictors (x) Are Independent and Observed with Negligible Error

```
library(car)
```

```
## Loading required package: carData
```

```
##
## Attaching package: 'car'
```

```
## The following object is masked from 'package:DescTools':
##
##     Recode
```

```
## The following object is masked from 'package:purrr':
##
##     some
```

```
## The following object is masked from 'package:dplyr':
##
##     recode
```

```
durbinWatsonTest(mod1_CAR1)
```

```
##  lag Autocorrelation D-W Statistic p-value
##    1        -0.02223         2.041    0.87
##  Alternative hypothesis: rho != 0
```

The null hypothesis states that the errors are not auto-correlated with themselves (they are independent). Thus, if we achieve a p-value > 0.05, 0.836, we would fail to reject the null hypothesis. This would give us enough evidence to state that our independence assumption is met!

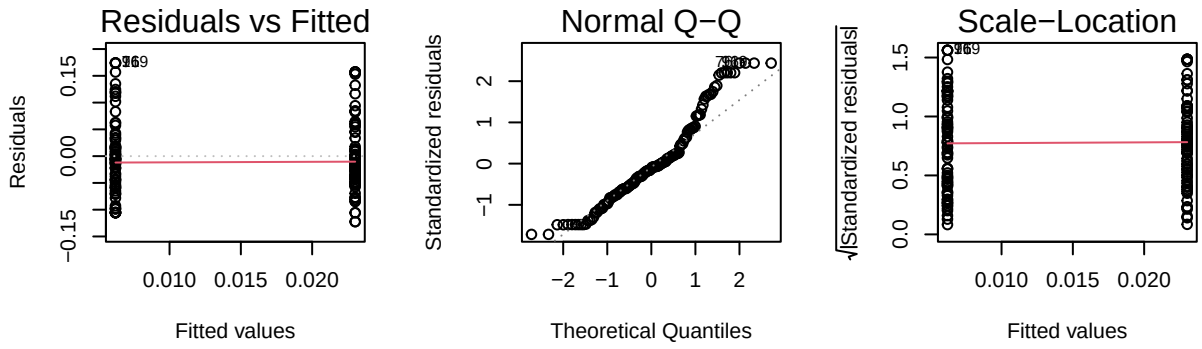
0.4.3 Assumption Three: Residual Errors Have a Mean Value of Zero

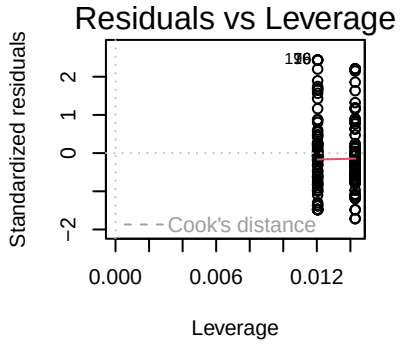
In the above plot, we can see that the red line is below 0 for low fitted values and high fitted values. This indicates that the residual errors have a mean value of below 0

0.4.4 Assumption Four: Residual Errors Have Constant Variance

We can check this assumption using the Scale-Location plot. In this plot we can see the fitted values vs the square root of the standardized residuals. Ideally, we would want to see the residual points equally spread around the red line, which would indicate constant variance.

```
par(mfrow=c(2,3))
plot(mod1_CAR1)
```






```
library(car)
ncvTest(lm(car_1 ~ covid_19, data = data))
```

```
## Non-constant Variance Score Test
## Variance formula: ~ fitted.values
## Chisquare = 0.2674, Df = 1, p = 0.61
```

The null hypothesis states that there is constant variance. a pvalue > 0.05, suggests you would fail to reject the null. This means you have enough evidence to state that your assumption is met!

All assumptions have been met, incuding the residually errors are normally distributed.

There is a marginally significant negative effect of COVID19 on CAR1 ($p < 0.1$) but not in CAR2.

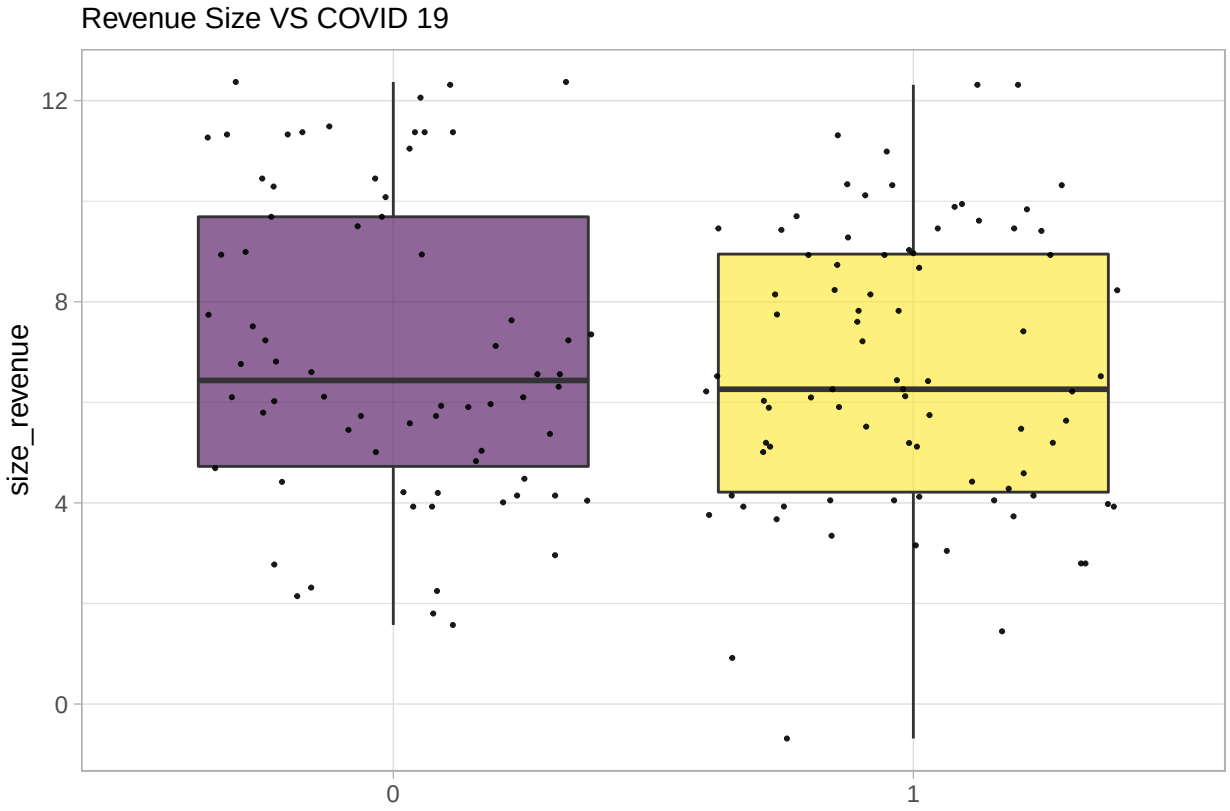
Note that a linear model with a two level factor (with similar sample size per factor) is equivalent to a T-student test. Then, coefficients here show the mean of the response variable for group COVID19 = 0 and the effect of the second level. Then, for CAR1, the mean of the COVID 19 = 0 group is 0.035, while the effect of the second level (COVID 19 = 1) is -0.028. Then, the mean for the second level in CAR1 is 0.035 - 0.028 = 0.07). The significance of COVID191 shows whether the difference is statistically significative.

0.5 HYPOTHESIS 2

The size has a positive impact on the cumulative abnormal return (CAR = dependent variable) during COVID-19.

0.5.1 Plotting Covid19 against Revenue

```
data %>%
  ggplot( aes(x=covid_19, y=size_revenue, fill=covid_19)) +
    geom_boxplot() +
    scale_fill_viridis(discrete = TRUE, alpha=0.6) +
    geom_jitter(color="black", size=0.4, alpha=0.9) +
    theme_light() +
    theme(
      legend.position="none",
      plot.title = element_text(size=11)
    ) +
    ggtitle("Revenue Size VS COVID 19") +
    xlab("")
```



Note that there are no outliers.

```
mod2_CAR1 <- lm(car_1 ~ covid_19 * size_revenue, data = data)
summary(mod2_CAR1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 * size_revenue, data = data)
##
## Residuals:
```

```
##      Min       1Q   Median       3Q      Max
## -0.15359 -0.04855 -0.00343  0.03191  0.17294
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)              6.50e-02   2.13e-02    3.05   0.0027 **
## covid_191               -1.99e-02   2.94e-02   -0.68   0.5005
## size_revenue            -5.97e-03   2.78e-03   -2.14   0.0338 *
## covid_191:size_revenue   9.62e-05   3.97e-03    0.02   0.9807
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0702 on 149 degrees of freedom
## Multiple R-squared:  0.0691, Adjusted R-squared:  0.0503
## F-statistic: 3.68 on 3 and 149 DF,  p-value: 0.0135
```

```
kable(extractCoefs(mod2_CAR1))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_1	COVID190	0.065	0.021	3.050	0.003
car_1	covid_191	-0.020	0.029	-0.675	0.500
car_1	size_revenue	-0.006	0.003	-2.143	0.034
car_1	covid_191:size_revenue	0.000	0.004	0.024	0.981

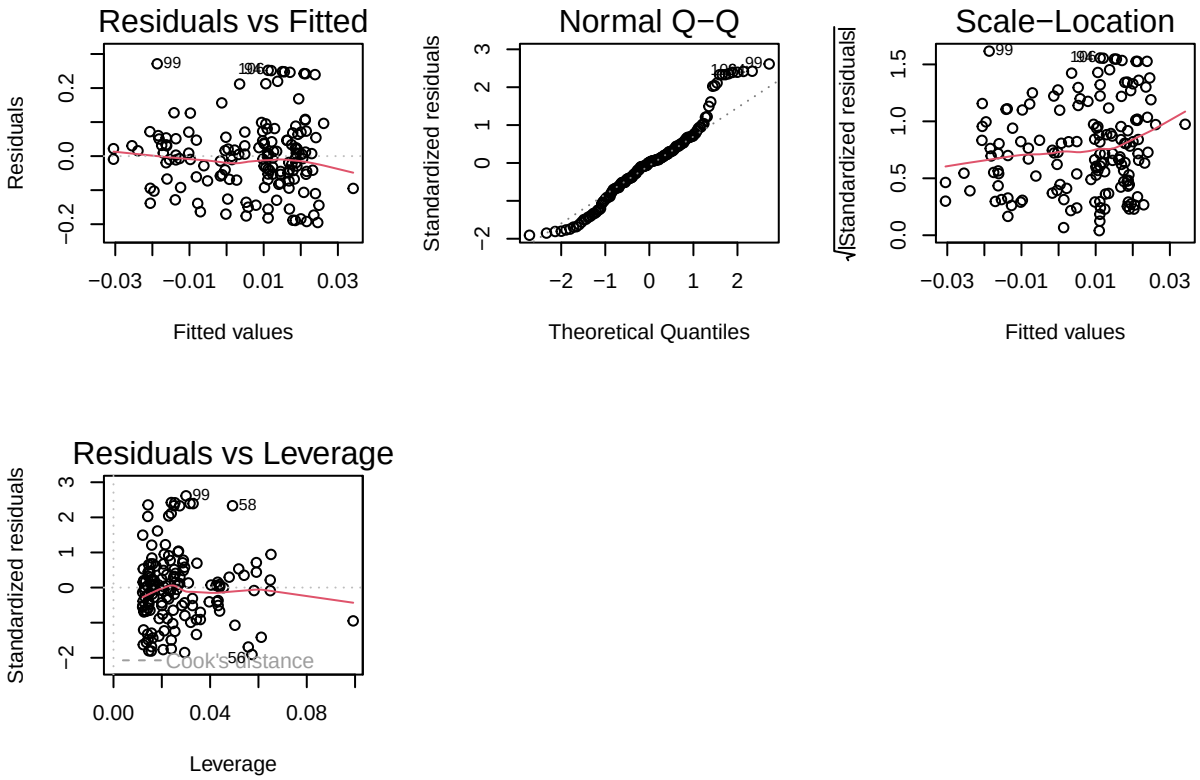
```
mod2_CAR2 <- lm(car_2 ~ covid_19 * size_revenue, data = data)
summary(mod2_CAR2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 * size_revenue, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.19515 -0.06106  0.00157  0.04684  0.27120
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)              0.02710    0.03197    0.85     0.40
## covid_191                0.00362    0.04417    0.08     0.93
## size_revenue            -0.00140    0.00418   -0.34     0.74
## covid_191:size_revenue -0.00357    0.00597   -0.60     0.55
##
## Residual standard error: 0.105 on 149 degrees of freedom
## Multiple R-squared:  0.0182, Adjusted R-squared:  -0.00154
## F-statistic: 0.922 on 3 and 149 DF,  p-value: 0.432
```

```
kable(extractCoefs(mod2_CAR2))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_2	COVID190	0.027	0.032	0.848	0.398
car_2	covid_191	0.004	0.044	0.082	0.935
car_2	size_revenue	-0.001	0.004	-0.336	0.737
car_2	covid_191:size_revenue	-0.004	0.006	-0.598	0.551

```
par(mfrow=c(2,3))
plot(mod2_CAR2)
```



Use the principles of checking for assumptions on linear models from the first hypothesis test.

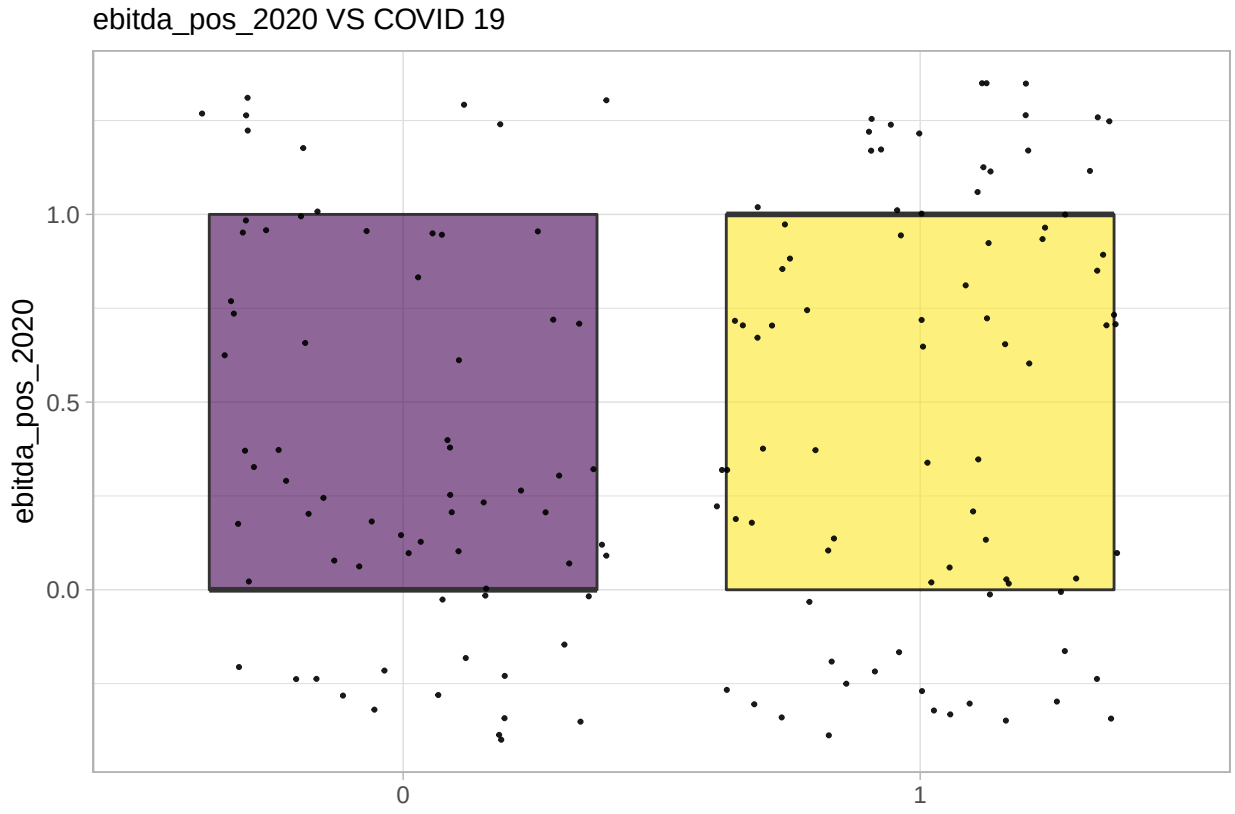
The effect of covid on CAR1 is maintained, but the relatiopnship is thought to be statistically significant at a much lower significant level, but there is no effect of size revenue nor interaction between size revenue and COVID. No significant effects are detected for CAR2.

0.6 Hypothesis 3

The financial strength has a positive impact on the cumulative abnormal return (CAR = dependent variable) during COVID-19.

0.6.1 COVID 19 VS EBITDA

```
data %>%
  ggplot( aes(x=covid_19, y=ebitda_pos_2020, fill=covid_19)) +
    geom_boxplot() +
    scale_fill_viridis(discrete = TRUE, alpha=0.6) +
    geom_jitter(color="black", size=0.4, alpha=0.9) +
    theme_light() +
    theme(
      legend.position="none",
      plot.title = element_text(size=11)
    ) +
    ggtitle("ebitda_pos_2020 VS COVID 19") +
    xlab("")
```



Note: Mean and median are equal, 1st quartile and minimum number are equal, 3rd quartile and max are equal

```
mod3_CAR1 <- lm(car_1 ~ covid_19 * ebitda_pos_2020, data = data)
summary(mod3_CAR1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 * ebitda_pos_2020, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -0.12692 -0.04709 -0.00929  0.03414  0.17816
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  0.0276     0.0107    2.56    0.011 *
## covid_191                   -0.0255     0.0158   -1.62    0.108
## ebitda_pos_2020             -0.0127     0.0180   -0.71    0.480
## covid_191:ebitda_pos_2020    0.0205     0.0240    0.86    0.393
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0721 on 149 degrees of freedom
## Multiple R-squared:  0.0185, Adjusted R-squared:  -0.00126
## F-statistic: 0.936 on 3 and 149 DF,  p-value: 0.425
```

```
kable(extractCoefs(mod3_CAR1))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_1	COVID190	0.028	0.011	2.565	0.011
car_1	covid_191	-0.026	0.016	-1.617	0.108
car_1	ebitda_pos_2020	-0.013	0.018	-0.707	0.480
car_1	covid_191:ebitda_pos_2020	0.021	0.024	0.857	0.393

At a 90% level of siginificance, the relationship/interaction between car 1 and Covid is significant. The other interactions are considered not to be significant, at any other higher level of significance. Taking the p-value of the model at a 90% level of significance, the relationship between car1, EBITDA and COVID 19 is not significant. Examining the F-value, it is less than 1, suggesting that the null hypothesis: That the car 1 and covid19 + ebitda have a significant relationship is false.

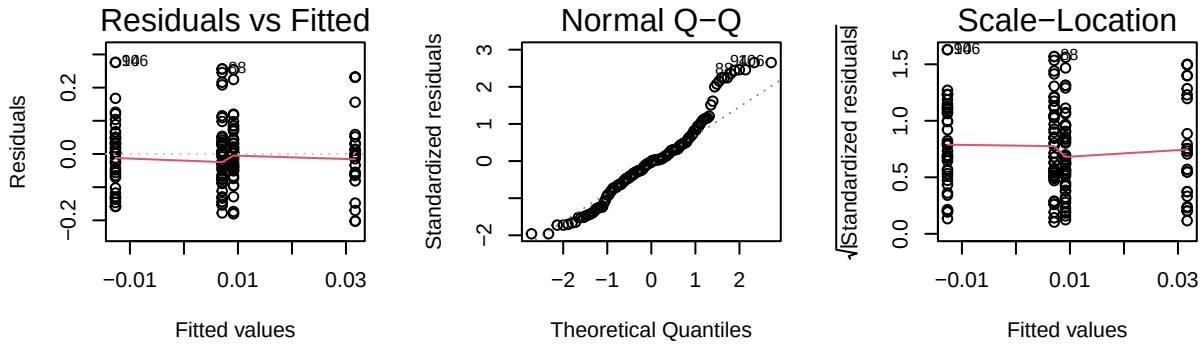
```
mod3_CAR2 <- lm(car_2 ~ covid_19 * ebitda_pos_2020, data = data)
summary(mod3_CAR2)
```

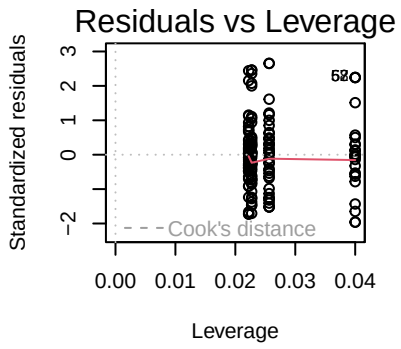
```
##
## Call:
## lm(formula = car_2 ~ covid_19 * ebitda_pos_2020, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.20229 -0.06318 -0.00208  0.04542  0.27601
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 0.00918    0.01571    0.58     0.56
## covid_191                  -0.02185    0.02305   -0.95     0.34
## ebitda_pos_2020             0.02253    0.02628    0.86     0.39
## covid_191:ebitda_pos_2020 -0.00277    0.03504   -0.08     0.94
##
## Residual standard error: 0.105 on 149 degrees of freedom
## Multiple R-squared:  0.0181, Adjusted R-squared:  -0.00164
## F-statistic: 0.917 on 3 and 149 DF,  p-value: 0.434
```

```
kable(extractCoefs(mod3_CAR2))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_2	COVID190	0.009	0.016	0.584	0.560
car_2	covid_191	-0.022	0.023	-0.948	0.345
car_2	ebitda_pos_2020	0.023	0.026	0.857	0.393
car_2	covid_191:ebitda_pos_2020	-0.003	0.035	-0.079	0.937

```
par(mfrow=c(2,3))
plot(mod3_CAR2)
```

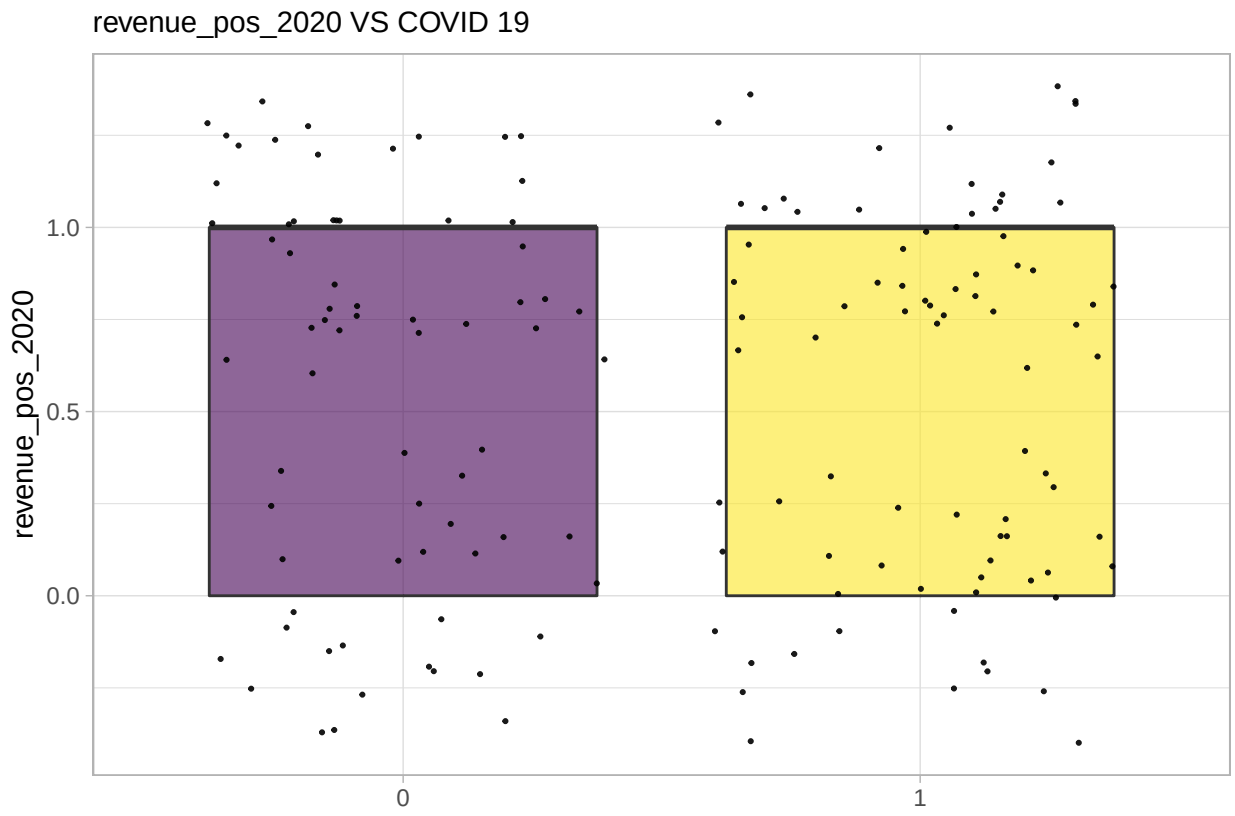




There are no significant effects on CAR2 that are detected.

```
data %>%
  ggplot( aes(x=covid_19, y=revenue_pos_2020, fill=covid_19)) +
    geom_boxplot() +
    scale_fill_viridis(discrete = TRUE, alpha=0.6) +
    geom_jitter(color="black", size=0.4, alpha=0.9) +
    theme_light() +
    theme(
      legend.position="none",
      plot.title = element_text(size=11)
    ) +
```

```
    ggtitle("revenue_pos_2020 VS COVID 19") +
    xlab("")
```



Revenue not affectd by Covid from plots

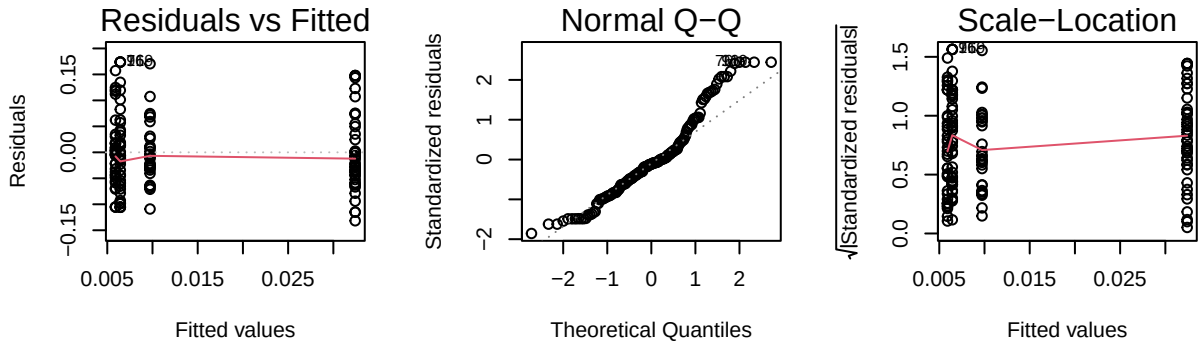
```
mod4_CAR1 <- lm(car_1 ~ covid_19 * revenue_pos_2020, data = data)
summary(mod4_CAR1)
```

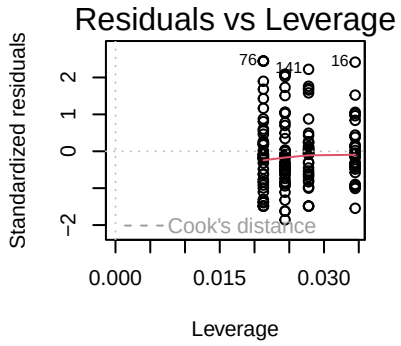
```
##
## Call:
## lm(formula = car_1 ~ covid_19 * revenue_pos_2020, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.13177 -0.04481 -0.00803  0.03097  0.17378
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  0.00973    0.01334    0.73     0.47
## covid_191                   -0.00382    0.01793   -0.21     0.83
## revenue_pos_2020             0.02268    0.01744    1.30     0.20
## covid_191:revenue_pos_2020 -0.02215    0.02361   -0.94     0.35
##
## Residual standard error: 0.0719 on 149 degrees of freedom
## Multiple R-squared:  0.0247, Adjusted R-squared:  0.00505
## F-statistic: 1.26 on 3 and 149 DF,  p-value: 0.291
```

```
kable(extractCoefs(mod4_CAR1))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_1	COVID190	0.010	0.013	0.729	0.467
car_1	covid_191	-0.004	0.018	-0.213	0.832
car_1	revenue_pos_2020	0.023	0.017	1.301	0.195
car_1	covid_191:revenue_pos_2020	-0.022	0.024	-0.938	0.350

```
par(mfrow=c(2,3))
plot(mod4_CAR1)
```





At a 90% level of siginificance, the relationship/interaction between car 1 and Covid is not significant. The other interactions are also considered not to be significant. However, Revenue and CAR1 seem to have a more significant relationship than the Covid and the Interaction between Revenue and Covid on CAR1.l Taking the p-value of the model at a 90% level of significance, the relationship between car1, revenue and COVID 19 is not significant, we reject the null hypothesis.

```
mod4_CAR2 <- lm(car_2 ~ covid_19 * revenue_pos_2020, data = data)
summary(mod4_CAR2)
```

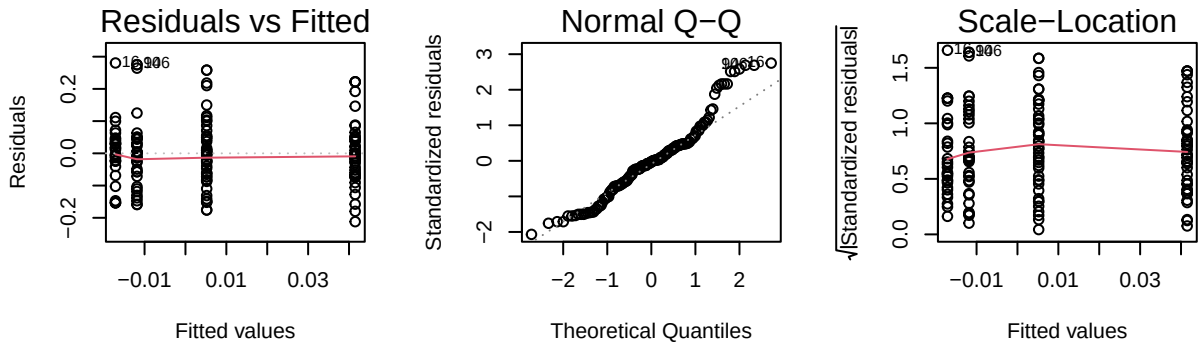
```
##
## Call:
## lm(formula = car_2 ~ covid_19 * revenue_pos_2020, data = data)
```

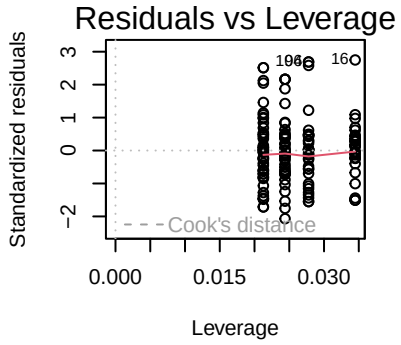
```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.21209 -0.06519 -0.00269  0.04705  0.28045
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                -0.01711    0.01928   -0.89    0.376
## covid_191                   0.00526    0.02591    0.20    0.839
## revenue_pos_2020            0.05862    0.02519    2.33    0.021 *
## covid_191:revenue_pos_2020 -0.04158    0.03411   -1.22    0.225
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.104 on 149 degrees of freedom
## Multiple R-squared:  0.0467, Adjusted R-squared:  0.0275
## F-statistic: 2.43 on 3 and 149 DF,  p-value: 0.0675
```

```
kable(extractCoefs(mod4_CAR2))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_2	COVID190	-0.017	0.019	-0.887	0.376
car_2	covid_191	0.005	0.026	0.203	0.839
car_2	revenue_pos_2020	0.059	0.025	2.327	0.021
car_2	covid_191:revenue_pos_2020	-0.042	0.034	-1.219	0.225

```
par(mfrow=c(2,3))
plot(mod4_CAR2)
```





At a 90% level of siginificance, the relationship/interaction between car2 and revenue statistically significant. The other interactions are not considered to be statistically significant. Taking the p-value of the model at a 90% level of significance, the relationship between car2 and the predictors is statistically significant. Examining the F-value, suggests that the null hypothesis: That the car2 and covid19, revenue_pos have a significant relationship is True.

```
mod5_CAR1 <- lm(car_1 ~ covid_19 * p_e_dummy, data = data)
summary(mod5_CAR1)
```

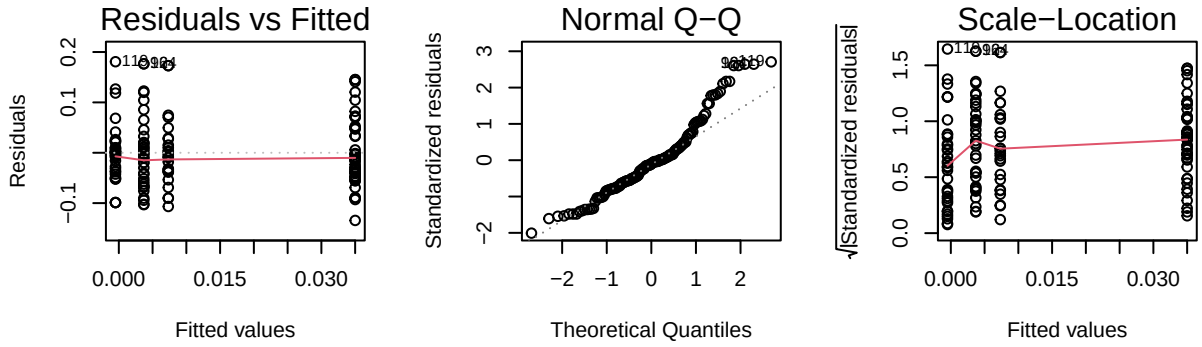
```
##
## Call:
## lm(formula = car_1 ~ covid_19 * p_e_dummy, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.13437 -0.04260 -0.00641  0.02678  0.18071
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)            0.00733    0.01354    0.54     0.59
## covid_191             -0.00782    0.01773   -0.44     0.66
## p_e_dummy1             0.02768    0.01703    1.63     0.11
## covid_191:p_e_dummy1 -0.02348    0.02342   -1.00     0.32
##
## Residual standard error: 0.0677 on 135 degrees of freedom
##   (14 observations deleted due to missingness)
```

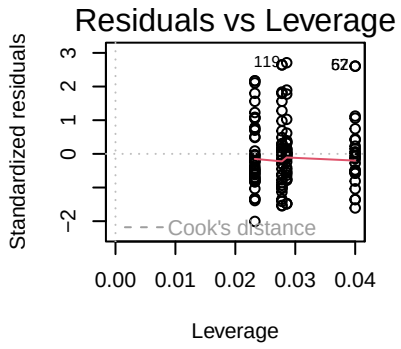
```
## Multiple R-squared:  0.0479, Adjusted R-squared:  0.0267
## F-statistic: 2.26 on 3 and 135 DF,  p-value: 0.0841
```

```
kable(extractCoefs(mod5_CAR1))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_1	COVID190	0.007	0.014	0.541	0.589
car_1	covid_191	-0.008	0.018	-0.441	0.660
car_1	p_e_dummy1	0.028	0.017	1.625	0.106
car_1	covid_191:p_e_dummy1	-0.023	0.023	-1.003	0.318

```
par(mfrow=c(2,3))
plot(mod5_CAR1)
```





At a 90% level of siginificance, the relationship/interaction between car 1 and Covid is not statistically significant. The other interactions are also considered not to be significant. Taking the p-value of the model at a 90% level of significance, the relationship between car1, p_e_dummy and COVID 19 is statistically significant. Examining the F-value, suggests that the null hypothesis: That the car 1 and covid19, p_e_dummy does have a significant relationship is True.

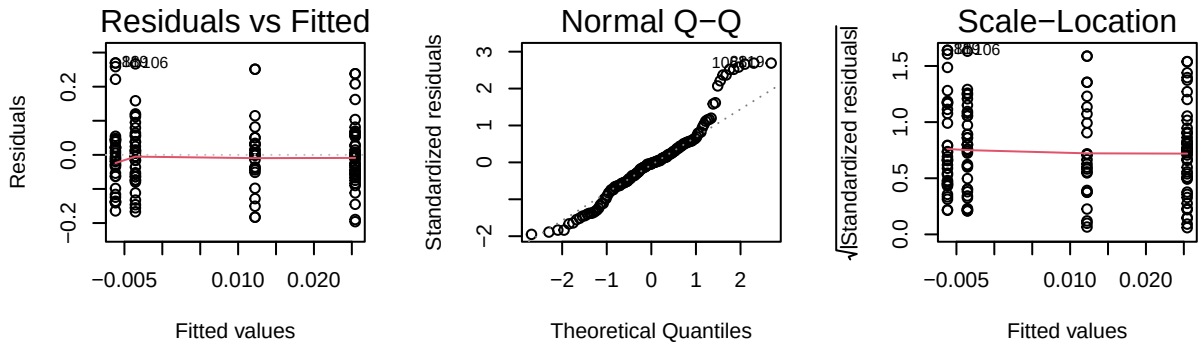
```
mod5_CAR2 <- lm(car_2 ~ covid_19 * p_e_dummy, data = data)
summary(mod5_CAR2)
```

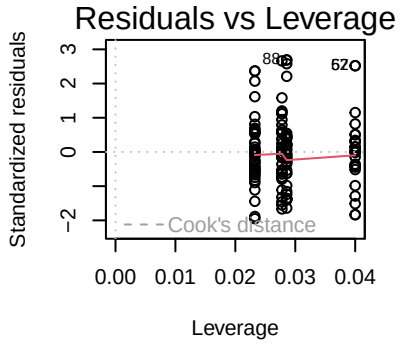
```
##
## Call:
## lm(formula = car_2 ~ covid_19 * p_e_dummy, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.19602 -0.05785 -0.00435  0.04423  0.26952
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)             0.0122     0.0203    0.60     0.55
## covid_191              -0.0184     0.0266   -0.69     0.49
## p_e_dummy1              0.0132     0.0256    0.52     0.61
## covid_191:p_e_dummy1  -0.0106     0.0352   -0.30     0.76
##
## Residual standard error: 0.102 on 135 degrees of freedom
##   (14 observations deleted due to missingness)
## Multiple R-squared:  0.0178, Adjusted R-squared:  -0.00399
## F-statistic: 0.817 on 3 and 135 DF,  p-value: 0.487
```

```
kable(extractCoefs(mod5_CAR2))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_2	COVID190	0.012	0.020	0.601	0.549
car_2	covid_191	-0.018	0.027	-0.691	0.491
car_2	p_e_dummy1	0.013	0.026	0.517	0.606
car_2	covid_191:p_e_dummy1	-0.011	0.035	-0.301	0.764

```
par(mfrow=c(2,3))
plot(mod5_CAR2)
```





At a 90% level of siginificance, the relationship/interaction between car2 and the predictors is not statistically significant. Examining the p-value of the model at a 90% level of significance, the relationship between car1 and the predictors is not statistically significant. Examining the F-value, it is less than 1,suggests that the null hypothesis: That the car 1 and the predictors have a significant relationship is False.

PE dummy 1 have a marginally significant effect on CAR1, but no interaction with COVID is detected. When included, the relationship between CAR1 and COVID disappears.

Revenue pos 2020 have a significant positive effect on CAR2 ($p < 0.05$).

Note, however, that when relatively small sample sizes it is not recommended to estimate a relatively high number of parameters, so it would be better tbo test for simple effects with the given datsaet.

0.7 Hypothesis 4

The financial strength together with the size has a positive impact on the cumulative abnormal return (CAR = dependent variable) during COVID-19.

```
mod6_CAR1 <- lm(car_1 ~ covid_19 * size_revenue * ebitda_pos_2020, data = data)
summary(mod6_CAR1)
```

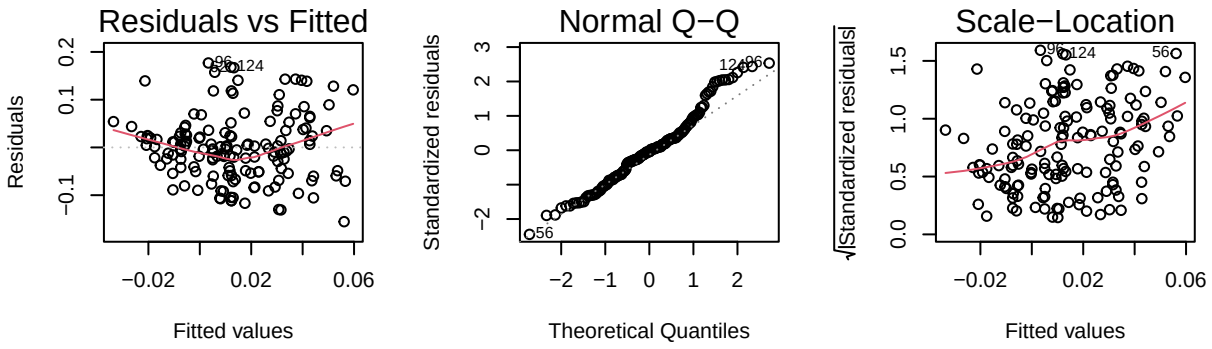
```
##
## Call:
## lm(formula = car_1 ~ covid_19 * size_revenue * ebitda_pos_2020,
##     data = data)
##
```

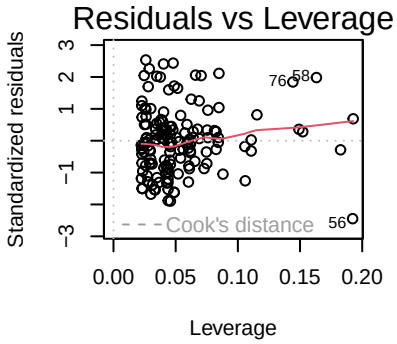
```
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.15551 -0.04893 -0.00303  0.03084  0.17688
##
## Coefficients:
##                                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)                              0.06489    0.02559    2.54    0.012 *
## covid_191                               -0.03863    0.03783   -1.02    0.309
## size_revenue                            -0.00527    0.00329   -1.60    0.112
## ebitda_pos_2020                          0.00576    0.04739    0.12    0.903
## covid_191:size_revenue                   0.00171    0.00498    0.34    0.732
## covid_191:ebitda_pos_2020                0.03587    0.06294    0.57    0.570
## size_revenue:ebitda_pos_2020            -0.00279    0.00631   -0.44    0.659
## covid_191:size_revenue:ebitda_pos_2020 -0.00262    0.00858   -0.31    0.760
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0707 on 145 degrees of freedom
## Multiple R-squared:  0.0805, Adjusted R-squared:  0.0361
## F-statistic: 1.81 on 7 and 145 DF,  p-value: 0.0887
```

```
kable(extractCoefs(mod6_CAR1))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_1	COVID190	0.065	0.026	2.536	0.012
car_1	covid_191	-0.039	0.038	-1.021	0.309
car_1	size_revenue	-0.005	0.003	-1.601	0.112
car_1	ebitda_pos_2020	0.006	0.047	0.122	0.903
car_1	covid_191:size_revenue	0.002	0.005	0.343	0.732
car_1	covid_191:ebitda_pos_2020	0.036	0.063	0.570	0.570
car_1	size_revenue:ebitda_pos_2020	-0.003	0.006	-0.443	0.659
car_1	covid_191:size_revenue:ebitda_pos_2020	-0.003	0.009	-0.305	0.760

```
par(mfrow=c(2,3))
plot(mod6_CAR1)
```





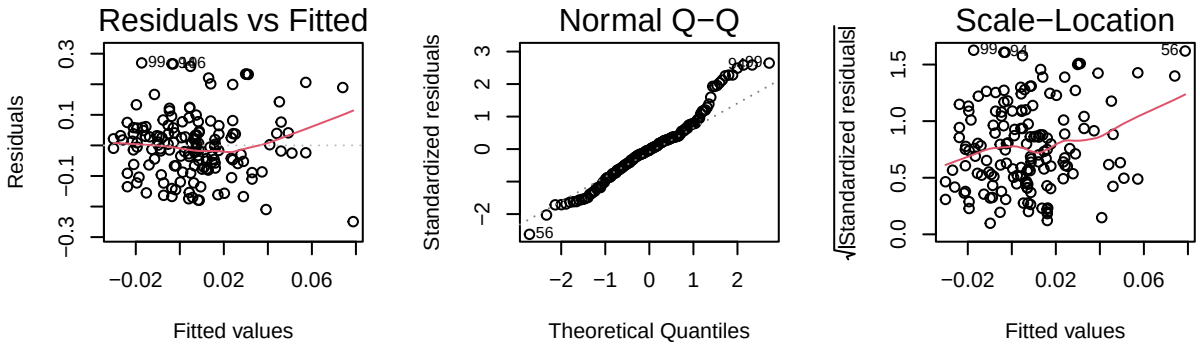

```
mod6_CAR2 <- lm(car_2 ~ covid_19 * size_revenue * ebitda_pos_2020, data = data)
summary(mod6_CAR2)
```

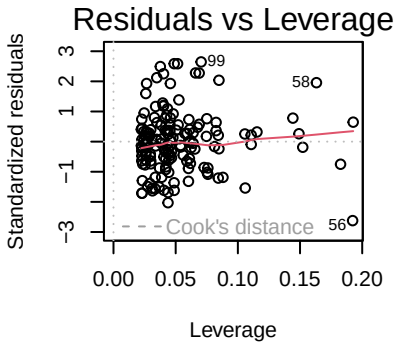
```
##
## Call:
## lm(formula = car_2 ~ covid_19 * size_revenue * ebitda_pos_2020,
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.24934 -0.06392 -0.00343  0.04247  0.26982
##
## Coefficients:
##                                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                                -0.00232    0.03827   -0.06     0.95
## covid_191                                   0.01118    0.05658    0.20     0.84
## size_revenue                                0.00162    0.00492    0.33     0.74
## ebitda_pos_2020                             0.09760    0.07087    1.38     0.17
## covid_191:size_revenue                     -0.00479    0.00745   -0.64     0.52
## covid_191:ebitda_pos_2020                  -0.05400    0.09413   -0.57     0.57
## size_revenue:ebitda_pos_2020               -0.01080    0.00944   -1.14     0.25
## covid_191:size_revenue:ebitda_pos_2020      0.00695    0.01283    0.54     0.59
##
## Residual standard error: 0.106 on 145 degrees of freedom
## Multiple R-squared:  0.037,  Adjusted R-squared:  -0.00948
## F-statistic: 0.796 on 7 and 145 DF,  p-value: 0.592
```

```
kable(extractCoefs(mod6_CAR2))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_2	COVID190	-0.002	0.038	-0.061	0.952
car_2	covid_191	0.011	0.057	0.198	0.844
car_2	size_revenue	0.002	0.005	0.330	0.742
car_2	ebitda_pos_2020	0.098	0.071	1.377	0.171
car_2	covid_191:size_revenue	-0.005	0.007	-0.643	0.522
car_2	covid_191:ebitda_pos_2020	-0.054	0.094	-0.574	0.567
car_2	size_revenue:ebitda_pos_2020	-0.011	0.009	-1.145	0.254
car_2	covid_191:size_revenue:ebitda_pos_2020	0.007	0.013	0.542	0.589

```
par(mfrow=c(2,3))
plot(mod6_CAR2)
```






```
mod7_CAR1 <- lm(car_1 ~ covid_19 * size_revenue * revenue_pos_2020, data = data)
summary(mod7_CAR1)
```

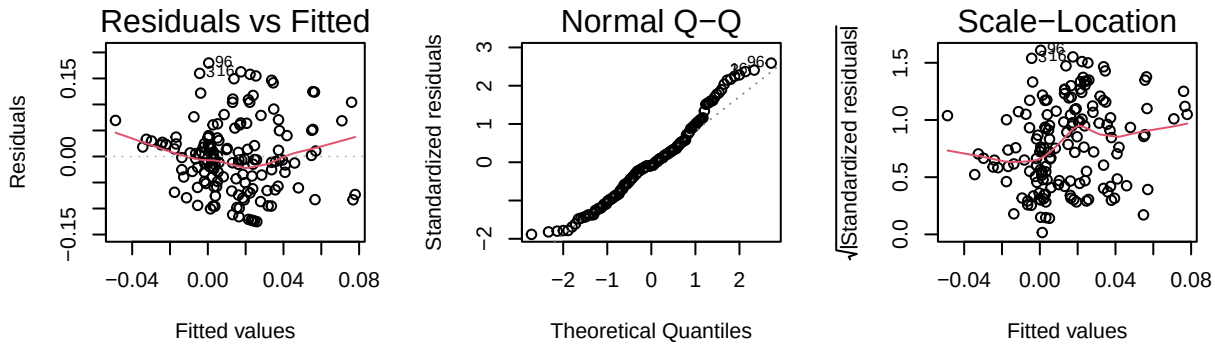
```
##
## Call:
## lm(formula = car_1 ~ covid_19 * size_revenue * revenue_pos_2020,
##     data = data)
```

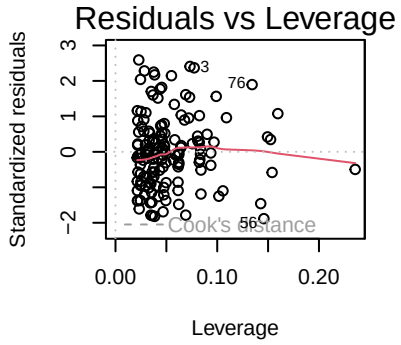
```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.12528 -0.04802 -0.00587  0.03565  0.17974
##
## Coefficients:
##                                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)                               0.02661    0.03274    0.81     0.42
## covid_191                                 0.01134    0.04551    0.25     0.80
## size_revenue                             -0.00206    0.00367   -0.56     0.57
## revenue_pos_2020                          0.07530    0.04611    1.63     0.10
## covid_191:size_revenue                   -0.00214    0.00532   -0.40     0.69
## covid_191:revenue_pos_2020               -0.04756    0.06335   -0.75     0.45
## size_revenue:revenue_pos_2020            -0.00912    0.00613   -1.49     0.14
## covid_191:size_revenue:revenue_pos_2020   0.00319    0.00868    0.37     0.71
##
## Residual standard error: 0.0702 on 145 degrees of freedom
## Multiple R-squared:  0.0944, Adjusted R-squared:  0.0507
## F-statistic: 2.16 on 7 and 145 DF,  p-value: 0.0412
```

```
kable(extractCoefs(mod7_CAR1))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_1	COVID190	0.027	0.033	0.813	0.418
car_1	covid_191	0.011	0.046	0.249	0.804
car_1	size_revenue	-0.002	0.004	-0.562	0.575
car_1	revenue_pos_2020	0.075	0.046	1.633	0.105
car_1	covid_191:size_revenue	-0.002	0.005	-0.402	0.689
car_1	covid_191:revenue_pos_2020	-0.048	0.063	-0.751	0.454
car_1	size_revenue:revenue_pos_2020	-0.009	0.006	-1.486	0.139
car_1	covid_191:size_revenue:revenue_pos_2020	0.003	0.009	0.368	0.714

```
par(mfrow=c(2,3))
plot(mod7_CAR1)
```






```
mod7_CAR2 <- lm(car_2 ~ covid_19 * size_revenue * revenue_pos_2020, data = data)
summary(mod7_CAR2)
```

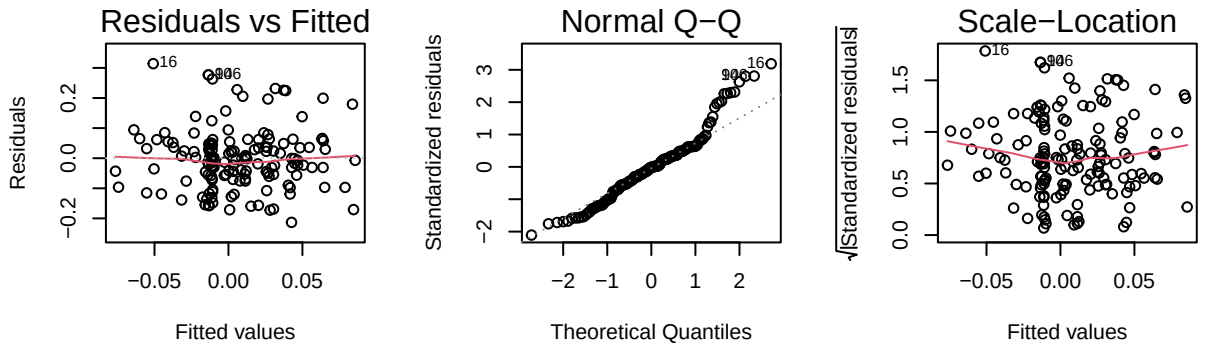
```
##
## Call:
## lm(formula = car_2 ~ covid_19 * size_revenue * revenue_pos_2020,
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.21322 -0.05721 -0.00152  0.04824  0.31420
##
## Coefficients:
##                                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                                -0.09046    0.04778   -1.89   0.0603 .
## covid_191                                   0.07524    0.06642    1.13   0.2592
## size_revenue                                0.00896    0.00536    1.67   0.0964 .
## revenue_pos_2020                            0.19942    0.06729    2.96   0.0036 **
## covid_191:size_revenue                     -0.00852    0.00776   -1.10   0.2741
## covid_191:revenue_pos_2020                 -0.10910    0.09246   -1.18   0.2399
## size_revenue:revenue_pos_2020              -0.01981    0.00895   -2.21   0.0285 *
## covid_191:size_revenue:revenue_pos_2020     0.00742    0.01267    0.59   0.5586
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

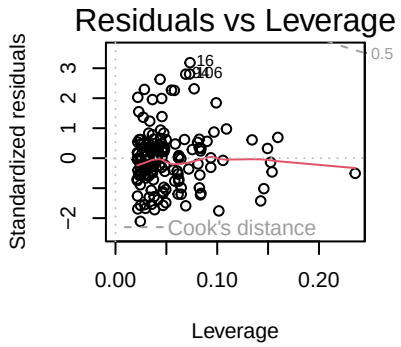
```
## Residual standard error: 0.102 on 145 degrees of freedom
## Multiple R-squared:  0.0966, Adjusted R-squared:  0.053
## F-statistic: 2.22 on 7 and 145 DF,  p-value: 0.0361
```

```
kable(extractCoefs(mod7_CAR2))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_2	COVID190	-0.090	0.048	-1.893	0.060
car_2	covid_191	0.075	0.066	1.133	0.259
car_2	size_revenue	0.009	0.005	1.673	0.096
car_2	revenue_pos_2020	0.199	0.067	2.963	0.004
car_2	covid_191:size_revenue	-0.009	0.008	-1.098	0.274
car_2	covid_191:revenue_pos_2020	-0.109	0.092	-1.180	0.240
car_2	size_revenue:revenue_pos_2020	-0.020	0.009	-2.213	0.028
car_2	covid_191:size_revenue:revenue_pos_2020	0.007	0.013	0.586	0.559

```
par(mfrow=c(2,3))
plot(mod7_CAR2)
```






```
mod8_CAR1 <- lm(car_1 ~ covid_19 * size_revenue * p_e_dummy, data = data)
summary(mod8_CAR1)
```

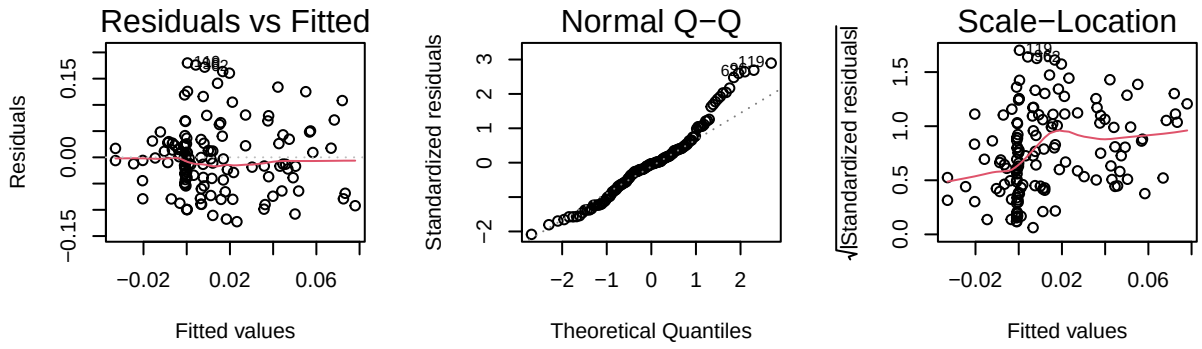
```
##
```

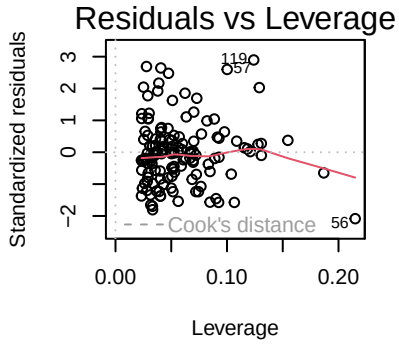
```
## Call:
## lm(formula = car_1 ~ covid_19 * size_revenue * p_e_dummy, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.12260 -0.03950 -0.00244  0.02695  0.17988
##
## Coefficients:
##                                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)                        0.028285   0.038902    0.73     0.47
## covid_191                         -0.027319   0.053976   -0.51     0.61
## size_revenue                      -0.002805   0.004895   -0.57     0.57
## p_e_dummy1                         0.062311   0.045930    1.36     0.18
## covid_191:size_revenue             0.002608   0.006867    0.38     0.70
## covid_191:p_e_dummy1              -0.018364   0.064846   -0.28     0.78
## size_revenue:p_e_dummy1           -0.005228   0.005854   -0.89     0.37
## covid_191:size_revenue:p_e_dummy1 -0.000899   0.008424   -0.11     0.92
##
## Residual standard error: 0.0664 on 131 degrees of freedom
##   (14 observations deleted due to missingness)
## Multiple R-squared:  0.113,  Adjusted R-squared:  0.0651
## F-statistic: 2.37 on 7 and 131 DF,  p-value: 0.0257
```

```
kable(extractCoefs(mod8_CAR1))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_1	COVID190	0.028	0.039	0.727	0.468
car_1	covid_191	-0.027	0.054	-0.506	0.614
car_1	size_revenue	-0.003	0.005	-0.573	0.568
car_1	p_e_dummy1	0.062	0.046	1.357	0.177
car_1	covid_191:size_revenue	0.003	0.007	0.380	0.705
car_1	covid_191:p_e_dummy1	-0.018	0.065	-0.283	0.777
car_1	size_revenue:p_e_dummy1	-0.005	0.006	-0.893	0.374
car_1	covid_191:size_revenue:p_e_dummy1	-0.001	0.008	-0.107	0.915

```
par(mfrow=c(2,3))
plot(mod8_CAR1)
```

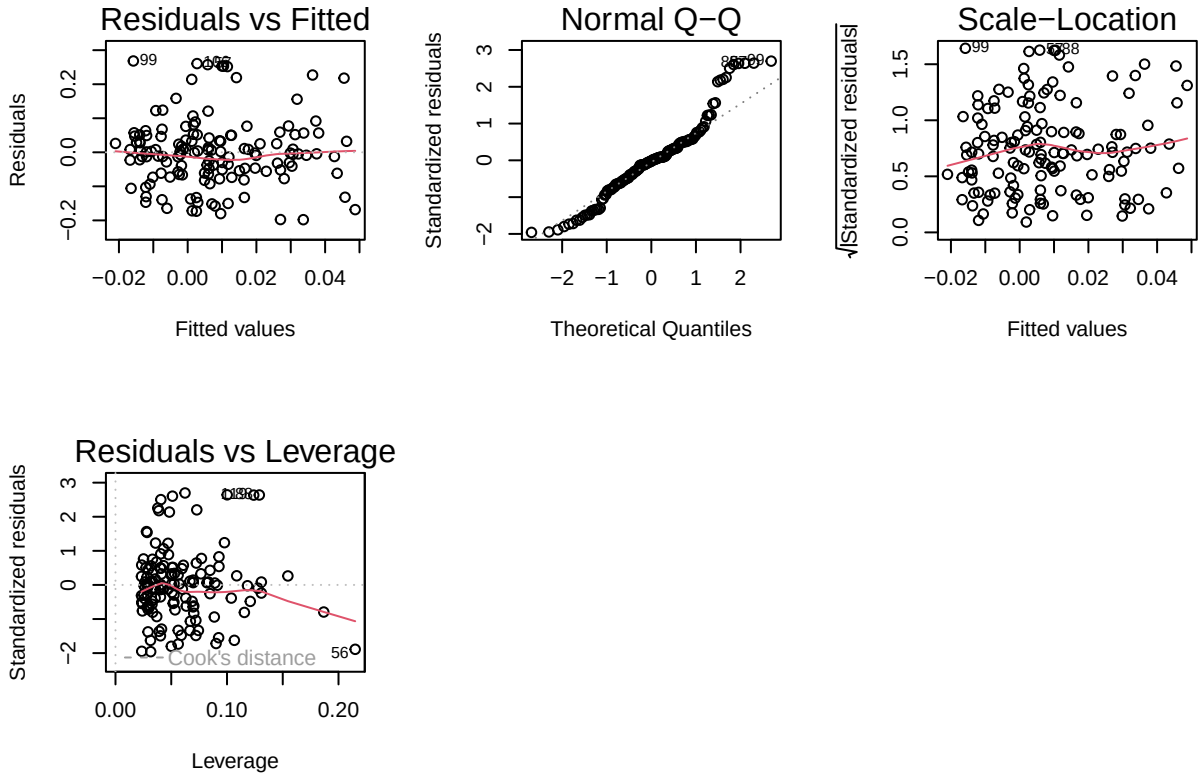





```
mod8_CAR2 <- lm(car_2 ~ covid_19 * size_revenue * p_e_dummy, data = data)
summary(mod8_CAR2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 * size_revenue * p_e_dummy, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.19795 -0.05912 -0.00216  0.04843  0.26831
##
## Coefficients:
##                                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)                        -0.00215    0.06022   -0.04     0.97
## covid_191                           0.02414    0.08355    0.29     0.77
## size_revenue                        0.00192    0.00758    0.25     0.80
## p_e_dummy1                          0.05775    0.07110    0.81     0.42
## covid_191:size_revenue             -0.00573    0.01063   -0.54     0.59
## covid_191:p_e_dummy1               -0.06847    0.10038   -0.68     0.50
## size_revenue:p_e_dummy1            -0.00628    0.00906   -0.69     0.49
## covid_191:size_revenue:p_e_dummy1   0.00781    0.01304    0.60     0.55
##
## Residual standard error: 0.103 on 131 degrees of freedom
##   (14 observations deleted due to missingness)
## Multiple R-squared:  0.0271, Adjusted R-squared:  -0.0248
## F-statistic: 0.522 on 7 and 131 DF,  p-value: 0.817
```

```
par(mfrow=c(2,3))
plot(mod8_CAR2)
```



0.7.1 Response to hypothesis 4

Revenue pos 2020 maintain its significat small positive effect on CAR2 when accounting for other explanatory variables. Revenue pos 2020 present a small negative marginally sigificant interaction with COVID19. The models are also not statistically significant at a 90% level of significance. However, these effects on CAR are very low (see estimates).

0.8 HYPOTHESIS 5

Local transaction (cross-border = 0) has a positive impact on the cumulative abnormal return (CAR = dependent variable).

```
data_copy = data
data$covid_19 = as.numeric(data$covid_19)
```

```
data = filter(data, covid_19!="0")
mod9_CAR1 <- lm(car_1 ~ cross_border * covid_19, data = data)
summary(mod9_CAR1)
```

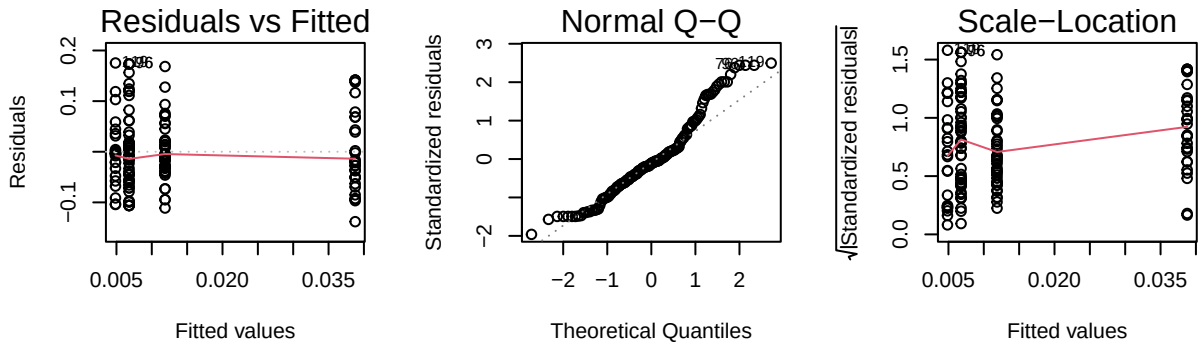
```
##
```

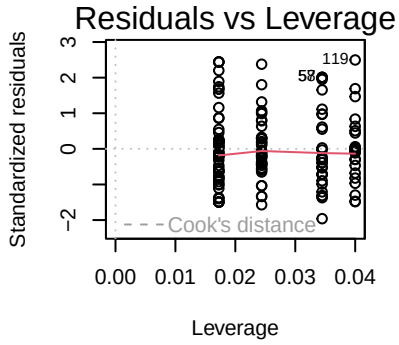
```
## Call:
## lm(formula = car_1 ~ cross_border * covid_19, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.13813 -0.04589 -0.00797  0.03251  0.17535
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)               0.01697    0.02429    0.70     0.49
## cross_border1             0.05570    0.03879    1.44     0.15
## covid_19                 -0.00509    0.01463   -0.35     0.73
## cross_border1:covid_19 -0.02881    0.02443   -1.18     0.24
##
## Residual standard error: 0.0717 on 149 degrees of freedom
## Multiple R-squared:  0.0292, Adjusted R-squared:  0.0097
## F-statistic:  1.5 on 3 and 149 DF,  p-value: 0.218
```

```
kable(extractCoefs(mod9_CAR1))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_1	COVID190	0.017	0.024	0.698	0.486
car_1	cross_border1	0.056	0.039	1.436	0.153
car_1	covid_19	-0.005	0.015	-0.348	0.728
car_1	cross_border1:covid_19	-0.029	0.024	-1.179	0.240

```
par(mfrow=c(2,3))
plot(mod9_CAR1)
```





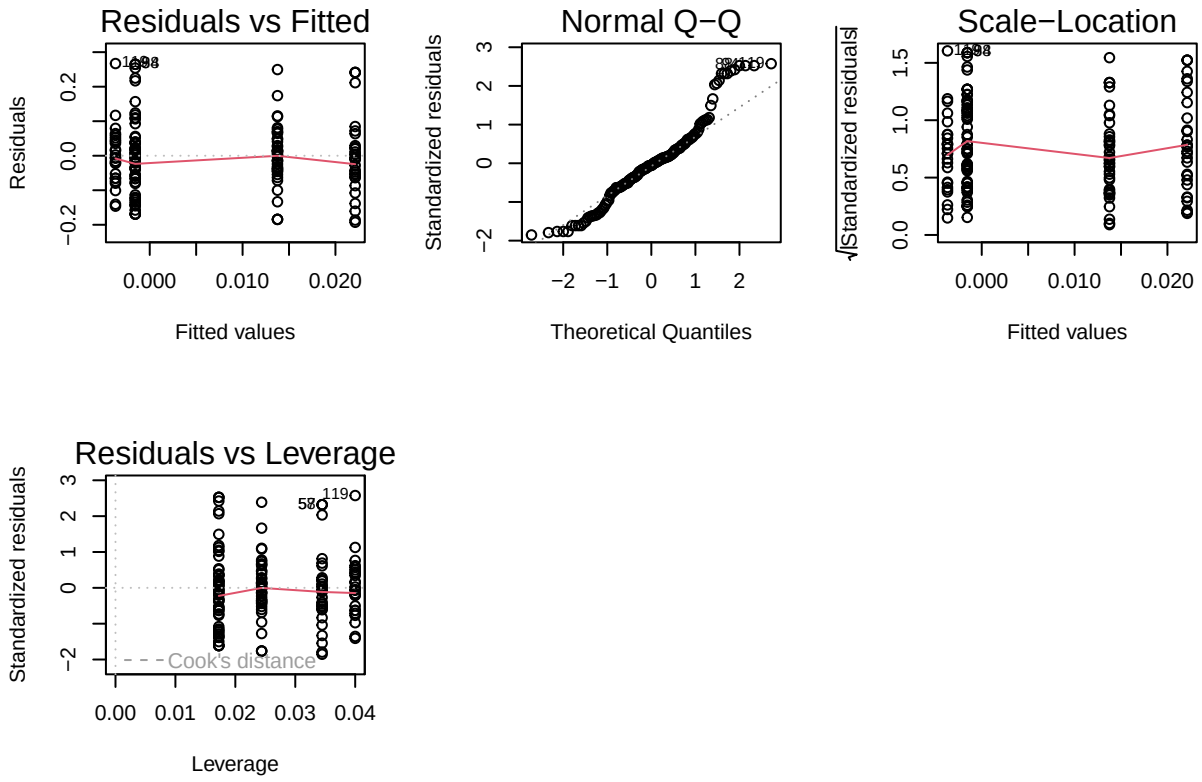

```
mod9_CAR2 <- lm(car_2 ~ cross_border * covid_19, data = data)
summary(mod9_CAR2)
```

```
##
## Call:
## lm(formula = car_2 ~ cross_border * covid_19, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.19271 -0.06123 -0.00511  0.04549  0.26703
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)               0.0291     0.0359    0.81     0.42
## cross_border1             0.0189     0.0573    0.33     0.74
## covid_19                 -0.0153     0.0216   -0.71     0.48
## cross_border1:covid_19   -0.0105     0.0361   -0.29     0.77
##
## Residual standard error: 0.106 on 149 degrees of freedom
## Multiple R-squared:  0.00926,    Adjusted R-squared:  -0.0107
## F-statistic: 0.464 on 3 and 149 DF,  p-value: 0.708
```

```
kable(extractCoefs(mod9_CAR2))
```

Dependent	Coefficient	Estimate	Std_error	T_value	P_value
car_2	COVID190	0.029	0.036	0.811	0.419
car_2	cross_border1	0.019	0.057	0.329	0.742
car_2	covid_19	-0.015	0.022	-0.709	0.479
car_2	cross_border1:covid_19	-0.010	0.036	-0.291	0.771

```
par(mfrow=c(2,3))
plot(mod9_CAR2)
```



0.8.1 Response to hypothesis 5

No effect of local transcation on CAR observed.

0.9 Extra Models:

```
mod_1_car1 = lm(car_1~covid_19, data = data)
summary(mod_1_car1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19, data = data)
```

```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.12238 -0.04531 -0.00861  0.03309  0.17401
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.0398     0.0189    2.11    0.037 *
## covid_19     -0.0168     0.0116   -1.44    0.151
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0718 on 151 degrees of freedom
## Multiple R-squared:  0.0136, Adjusted R-squared:  0.00706
## F-statistic: 2.08 on 1 and 151 DF,  p-value: 0.151
```

```
mod_1_car2 = lm(car_2~covid_19, data = data)
summary(mod_1_car2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.18780 -0.05860 -0.00542  0.04400  0.26554
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.0366     0.0277    1.32     0.19
## covid_19     -0.0194     0.0171   -1.14     0.26
##
## Residual standard error: 0.105 on 151 degrees of freedom
## Multiple R-squared:  0.0085, Adjusted R-squared:  0.00194
## F-statistic: 1.29 on 1 and 151 DF,  p-value: 0.257
```

```
mod_2_car1 = lm(car_1~covid_19+sector, data = data)
summary(mod_2_car1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + sector, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.12822 -0.04169 -0.00961  0.03495  0.16941
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 0.0942     0.0540    1.75    0.083 .
## covid_19                   -0.0248     0.0125   -1.98    0.049 *
## sectorEnergy and Power     -0.0691     0.0574   -1.20    0.231
## sectorFinancials           -0.0705     0.0559   -1.26    0.209
```

```
## sectorHealthcare          -0.0337     0.0539   -0.63    0.533
## sectorHigh Technology     -0.0242     0.0518   -0.47    0.641
## sectorIndustrials         -0.0629     0.0529   -1.19    0.236
## sectorInvestment firm     -0.0157     0.0543   -0.29    0.773
## sectorMaterials           -0.0389     0.0561   -0.69    0.490
## sectorReal Estate         -0.0348     0.0546   -0.64    0.525
## sectorRetail              -0.0597     0.0546   -1.09    0.276
## sectorTelecommunications  -0.0763     0.0563   -1.36    0.178
## sectorTransportation      -0.0240     0.0878   -0.27    0.785
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0715 on 140 degrees of freedom
## Multiple R-squared:  0.092,  Adjusted R-squared:  0.0142
## F-statistic: 1.18 on 12 and 140 DF,  p-value: 0.302
```

```
mod_2_car2 = lm(car_2~covid_19+sector, data = data)
summary(mod_2_car2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + sector, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.21059 -0.06004 -0.00334  0.05096  0.28433
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)                0.0954     0.0799    1.19     0.23
## covid_19                  -0.0236     0.0185   -1.27     0.20
## sectorEnergy and Power     0.0156     0.0849    0.18     0.85
## sectorFinancials          -0.1074     0.0828   -1.30     0.20
## sectorHealthcare          -0.0224     0.0799   -0.28     0.78
## sectorHigh Technology     -0.0416     0.0767   -0.54     0.59
## sectorIndustrials         -0.0573     0.0783   -0.73     0.47
## sectorInvestment firm     -0.0692     0.0805   -0.86     0.39
## sectorMaterials           -0.0727     0.0831   -0.87     0.38
## sectorReal Estate         -0.0749     0.0809   -0.93     0.36
## sectorRetail              -0.0576     0.0809   -0.71     0.48
## sectorTelecommunications  -0.0681     0.0833   -0.82     0.42
## sectorTransportation      -0.0432     0.1301   -0.33     0.74
##
## Residual standard error: 0.106 on 140 degrees of freedom
## Multiple R-squared:  0.0675, Adjusted R-squared:  -0.0124
## F-statistic: 0.844 on 12 and 140 DF,  p-value: 0.605
```

```
mod_3_car1 = lm(car_1~covid_19+diversification+cash+size_relative, data = data)
summary(mod_3_car1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + diversification + cash + size_relative,
```

```
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.12561 -0.04838 -0.00583  0.03072  0.17224
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       0.063366   0.032735    1.94    0.056 .
## covid_19         -0.019300   0.016309   -1.18    0.240
## diversification1  0.000412   0.028892    0.01    0.989
## cash1            -0.019718   0.022634   -0.87    0.386
## cashn.d.         -0.005969   0.032376   -0.18    0.854
## size_relative     0.001647   0.001628    1.01    0.315
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0745 on 83 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.0421, Adjusted R-squared:  -0.0156
## F-statistic: 0.73 on 5 and 83 DF,  p-value: 0.603
```

```
mod_3_car2 = lm(car_2~covid_19+diversification+cash+size_relative, data = data)
summary(mod_3_car2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + diversification + cash + size_relative,
##     data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.2056 -0.0656 -0.0170  0.0454  0.2592
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       0.05179    0.04900    1.06     0.29
## covid_19         -0.01673    0.02441   -0.69     0.49
## diversification1  0.00858    0.04325    0.20     0.84
## cash1            -0.02498    0.03388   -0.74     0.46
## cashn.d.          0.03053    0.04847    0.63     0.53
## size_relative    -0.00112    0.00244   -0.46     0.65
##
## Residual standard error: 0.112 on 83 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.0397, Adjusted R-squared:  -0.0182
## F-statistic: 0.686 on 5 and 83 DF,  p-value: 0.636
```

```
mod_4_car1 = lm(car_1~covid_19+diversification+cash+size_revenue+size_relative +(covid_19*size_revenue)
summary(mod_4_car1)
```

```
##
## Call:
```

```
## lm(formula = car_1 ~ covid_19 + diversification + cash + size_revenue +
##     size_relative + (covid_19 * size_revenue), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.12528 -0.05285 -0.00321  0.03170  0.16594
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)             0.126046   0.072017    1.75    0.084 .
## covid_19               -0.046308   0.043942   -1.05    0.295
## diversification1       -0.003693   0.029105   -0.13    0.899
## cash1                  -0.013555   0.023305   -0.58    0.562
## cashn.d.                0.000865   0.032797    0.03    0.979
## size_revenue           -0.009375   0.009340   -1.00    0.318
## size_relative           0.001175   0.001831    0.64    0.523
## covid_19:size_revenue   0.003722   0.005946    0.63    0.533
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0746 on 81 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.0635, Adjusted R-squared:  -0.0175
## F-statistic: 0.784 on 7 and 81 DF,  p-value: 0.603
```

```
mod_4_car2 = lm(car_2~covid_19+diversification+cash+size_revenue+size_relative +(covid_19*size_revenue)
summary(mod_4_car2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + diversification + cash + size_revenue +
##     size_relative + (covid_19 * size_revenue), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.2114 -0.0656 -0.0130  0.0491  0.2580
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)             0.100154   0.108738    0.92     0.36
## covid_19               -0.053811   0.066348   -0.81     0.42
## diversification1        0.007018   0.043945    0.16     0.87
## cash1                  -0.027577   0.035189   -0.78     0.44
## cashn.d.                0.030516   0.049521    0.62     0.54
## size_revenue           -0.006870   0.014102   -0.49     0.63
## size_relative          -0.000399   0.002764   -0.14     0.89
## covid_19:size_revenue   0.005473   0.008978    0.61     0.54
##
## Residual standard error: 0.113 on 81 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.0448, Adjusted R-squared:  -0.0378
## F-statistic: 0.542 on 7 and 81 DF,  p-value: 0.8
```

```r
mod_5_car1 = lm(car_1~covid_19+diversification+cash+size_revenue+size_category+size_relative +(covid_19*
summary(mod_5_car1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + diversification + cash + size_revenue +
##     size_category + size_relative + (covid_19 * size_category),
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.14289 -0.03963 -0.00408  0.02635  0.17019
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   0.019590   0.067346    0.29     0.77
## covid_19                     -0.014839   0.022861   -0.65     0.52
## diversification1              0.002942   0.028585    0.10     0.92
## cash1                        -0.008194   0.022970   -0.36     0.72
## cashn.d.                      0.005952   0.032819    0.18     0.86
## size_revenue                  0.000897   0.006066    0.15     0.88
## size_categorymedium           0.070110   0.058197    1.20     0.23
## size_categorysmall            0.030647   0.134995    0.23     0.82
## size_relative                 0.002758   0.001910    1.44     0.15
## covid_19:size_categorymedium -0.017125   0.032722   -0.52     0.60
## covid_19:size_categorysmall  -0.048251   0.083171   -0.58     0.56
##
## Residual standard error: 0.0725 on 78 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.147,  Adjusted R-squared:  0.0382
## F-statistic: 1.35 on 10 and 78 DF,  p-value: 0.22
```

```r
mod_5_car2 = lm(car_2~covid_19+diversification+cash+size_revenue+size_category+size_relative +(covid_19*
summary(mod_5_car2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + diversification + cash + size_revenue +
##     size_category + size_relative + (covid_19 * size_category),
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.21162 -0.06912 -0.00952  0.04402  0.27595
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 -0.02372    0.10428   -0.23     0.82
## covid_19                     0.00493    0.03540    0.14     0.89
## diversification1             0.01122    0.04426    0.25     0.80
## cash1                       -0.02197    0.03557   -0.62     0.54
## cashn.d.                     0.03993    0.05082    0.79     0.43
```

```
## size_revenue                   0.00354    0.00939    0.38     0.71
## size_categorymedium            0.10520    0.09011    1.17     0.25
## size_categorysmall             0.05285    0.20903    0.25     0.80
## size_relative                  0.00114    0.00296    0.38     0.70
## covid_19:size_categorymedium -0.04830    0.05067   -0.95     0.34
## covid_19:size_categorysmall  -0.07834    0.12878   -0.61     0.54
##
## Residual standard error: 0.112 on 78 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.0856, Adjusted R-squared:  -0.0317
## F-statistic: 0.73 on 10 and 78 DF,  p-value: 0.694
```

```
mod_6_car1 = lm(car_1~covid_19+diversification+cash+ebitda_pos_2020+size_relative +(covid_19*ebitda_pos
summary(mod_6_car1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + diversification + cash + ebitda_pos_2020 +
##     size_relative + (covid_19 * ebitda_pos_2020), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.1241 -0.0495 -0.0071  0.0331  0.1752
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)                0.06361    0.03962    1.61     0.11
## covid_19                  -0.02072    0.02169   -0.96     0.34
## diversification1           0.00101    0.02939    0.03     0.97
## cash1                     -0.02007    0.02294   -0.87     0.38
## cashn.d.                  -0.00632    0.03282   -0.19     0.85
## ebitda_pos_2020            0.00186    0.05591    0.03     0.97
## size_relative              0.00165    0.00165    1.00     0.32
## covid_19:ebitda_pos_2020   0.00186    0.03333    0.06     0.96
##
## Residual standard error: 0.0754 on 81 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.0432, Adjusted R-squared:  -0.0395
## F-statistic: 0.522 on 7 and 81 DF,  p-value: 0.815
```

```
mod_6_car2 = lm(car_2~covid_19+diversification+cash+ebitda_pos_2020+size_relative +(covid_19*ebitda_pos
summary(mod_6_car2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + diversification + cash + ebitda_pos_2020 +
##     size_relative + (covid_19 * ebitda_pos_2020), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.1906 -0.0656 -0.0116  0.0538  0.2537
##
## Coefficients:
```

```
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 0.03567    0.05852    0.61     0.54
## covid_19                   -0.01553    0.03204   -0.48     0.63
## diversification1            0.01455    0.04341    0.34     0.74
## cash1                      -0.02796    0.03388   -0.83     0.41
## cashn.d.                    0.02951    0.04848    0.61     0.54
## ebitda_pos_2020             0.05829    0.08259    0.71     0.48
## size_relative              -0.00106    0.00243   -0.44     0.66
## covid_19:ebitda_pos_2020 -0.01411    0.04924   -0.29     0.78
##
## Residual standard error: 0.111 on 81 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.066,  Adjusted R-squared:  -0.0148
## F-statistic: 0.817 on 7 and 81 DF,  p-value: 0.576
```

```
mod_7_car1 = lm(car_1~covid_19+diversification+cash+revenue_pos_2020+size_relative +(covid_19*revenue_p
summary(mod_7_car1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + diversification + cash + revenue_pos_2020 +
##     size_relative + (covid_19 * revenue_pos_2020), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.12709 -0.04811 -0.00467  0.03098  0.17286
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  0.058078   0.046456    1.25     0.21
## covid_19                    -0.016167   0.025912   -0.62     0.53
## diversification1            -0.000505   0.029973   -0.02     0.99
## cash1                       -0.020046   0.023058   -0.87     0.39
## cashn.d.                    -0.005811   0.032859   -0.18     0.86
## revenue_pos_2020             0.009199   0.056672    0.16     0.87
## size_relative                0.001644   0.001648    1.00     0.32
## covid_19:revenue_pos_2020 -0.005231   0.034176   -0.15     0.88
##
## Residual standard error: 0.0754 on 81 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.0424, Adjusted R-squared:  -0.0403
## F-statistic: 0.512 on 7 and 81 DF,  p-value: 0.823
```

```
mod_7_car2 = lm(car_2~covid_19+diversification+cash+revenue_pos_2020+size_relative +(covid_19*revenue_p
summary(mod_7_car2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + diversification + cash + revenue_pos_2020 +
##     size_relative + (covid_19 * revenue_pos_2020), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

```
## -0.1858 -0.0699 -0.0101  0.0500  0.2682
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                -0.00291    0.06882   -0.04     0.97
## covid_19                    0.00909    0.03838    0.24     0.81
## diversification1            0.00300    0.04440    0.07     0.95
## cash1                      -0.02647    0.03416   -0.77     0.44
## cashn.d.                    0.02970    0.04868    0.61     0.54
## revenue_pos_2020            0.08925    0.08395    1.06     0.29
## size_relative              -0.00112    0.00244   -0.46     0.65
## covid_19:revenue_pos_2020 -0.04014    0.05063   -0.79     0.43
##
## Residual standard error: 0.112 on 81 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.0599, Adjusted R-squared:  -0.0214
## F-statistic: 0.737 on 7 and 81 DF,  p-value: 0.641
```

```
mod_8_car1 = lm(car_1~covid_19+diversification+cash+p_e_dummy+size_relative +(covid_19*p_e_dummy), data
summary(mod_8_car1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + diversification + cash + p_e_dummy +
##     size_relative + (covid_19 * p_e_dummy), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.14065 -0.04412 -0.00483  0.02212  0.16726
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)           0.087185   0.046401    1.88    0.064 .
## covid_19             -0.022960   0.024245   -0.95    0.347
## diversification1      0.018047   0.030162    0.60    0.551
## cash1                -0.048441   0.023502   -2.06    0.043 *
## cashn.d.             -0.047667   0.034211   -1.39    0.168
## p_e_dummy1            0.008038   0.052839    0.15    0.880
## size_relative         0.000383   0.001671    0.23    0.820
## covid_19:p_e_dummy1   0.005711   0.032621    0.18    0.862
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0703 on 72 degrees of freedom
##   (73 observations deleted due to missingness)
## Multiple R-squared:  0.102,  Adjusted R-squared:  0.0152
## F-statistic: 1.17 on 7 and 72 DF,  p-value: 0.328
```

```
mod_8_car2 = lm(car_2~covid_19+diversification+cash+p_e_dummy+size_relative +(covid_19*p_e_dummy), data
summary(mod_8_car2)
```

```
##
## Call:
```

```
## lm(formula = car_2 ~ covid_19 + diversification + cash + p_e_dummy +
##     size_relative + (covid_19 * p_e_dummy), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.19660 -0.06872  0.00102  0.04955  0.27517
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)          0.06676    0.07203    0.93    0.357
## covid_19            -0.00723    0.03764   -0.19    0.848
## diversification1     0.01871    0.04682    0.40    0.691
## cash1               -0.06378    0.03648   -1.75    0.085 .
## cashn.d.            -0.03980    0.05311   -0.75    0.456
## p_e_dummy1           0.04003    0.08203    0.49    0.627
## size_relative       -0.00295    0.00259   -1.14    0.259
## covid_19:p_e_dummy1 -0.01011    0.05064   -0.20    0.842
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.109 on 72 degrees of freedom
##   (73 observations deleted due to missingness)
## Multiple R-squared:  0.068,  Adjusted R-squared:  -0.0226
## F-statistic: 0.75 on 7 and 72 DF,  p-value: 0.631
```

```
mod_9_car1 = lm(car_1~covid_19+diversification+cash+ebitda_pos_2020+size_revenue+size_relative +(covid_
summary(mod_9_car1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + diversification + cash + ebitda_pos_2020 +
##     size_revenue + size_relative + (covid_19 * ebitda_pos_2020 *
##     size_revenue), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.12437 -0.04971 -0.00731  0.03104  0.17683
##
## Coefficients:
##                                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)                            0.12314    0.08690    1.42     0.16
## covid_19                              -0.05631    0.05415   -1.04     0.30
## diversification1                      -0.00485    0.02988   -0.16     0.87
## cash1                                 -0.01607    0.02376   -0.68     0.50
## cashn.d.                              -0.00419    0.03351   -0.12     0.90
## ebitda_pos_2020                        0.04670    0.15682    0.30     0.77
## size_revenue                          -0.00898    0.01141   -0.79     0.43
## size_relative                          0.00117    0.00186    0.63     0.53
## covid_19:ebitda_pos_2020               0.00718    0.09209    0.08     0.94
## covid_19:size_revenue                  0.00535    0.00748    0.72     0.48
## ebitda_pos_2020:size_revenue          -0.00602    0.02081   -0.29     0.77
## covid_19:ebitda_pos_2020:size_revenue -0.00122    0.01248   -0.10     0.92
##
## Residual standard error: 0.0756 on 77 degrees of freedom
```

```
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.0849, Adjusted R-squared:  -0.0458
## F-statistic: 0.65 on 11 and 77 DF,  p-value: 0.78
```

```
mod_9_car2 = lm(car_2~covid_19+diversification+cash+ebitda_pos_2020+size_revenue+size_relative +(covid_
summary(mod_9_car2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + diversification + cash + ebitda_pos_2020 +
##     size_revenue + size_relative + (covid_19 * ebitda_pos_2020 *
##     size_revenue), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.1767 -0.0717 -0.0125  0.0523  0.2592
##
## Coefficients:
##                                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)                       -0.018646   0.127967   -0.15    0.885
## covid_19                           0.000353   0.079747    0.00    0.996
## diversification1                   0.017916   0.044006    0.41    0.685
## cash1                             -0.036088   0.034997   -1.03    0.306
## cashn.d.                           0.020873   0.049347    0.42    0.673
## ebitda_pos_2020                    0.433405   0.230945    1.88    0.064 .
## size_revenue                       0.007953   0.016807    0.47    0.637
## size_relative                     -0.000517   0.002738   -0.19    0.851
## covid_19:ebitda_pos_2020          -0.196677   0.135624   -1.45    0.151
## covid_19:size_revenue             -0.001719   0.011012   -0.16    0.876
## ebitda_pos_2020:size_revenue      -0.052257   0.030642   -1.71    0.092 .
## covid_19:ebitda_pos_2020:size_revenue  0.025215   0.018374    1.37    0.174
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.111 on 77 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.112,  Adjusted R-squared:  -0.0147
## F-statistic: 0.884 on 11 and 77 DF,  p-value: 0.559
```

```
mod_10_car1 = lm(car_1~covid_19+diversification+cash+ebitda_pos_2020+size_revenue+size_relative +(covid_
summary(mod_10_car1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + diversification + cash + ebitda_pos_2020 +
##     size_revenue + size_relative + (covid_19 * revenue_pos_2020 *
##     size_revenue), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.13017 -0.05471 -0.00489  0.03300  0.16773
##
## Coefficients:
```

```
##                                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)                              0.135251   0.109700    1.23     0.22
## covid_19                                -0.060228   0.066512   -0.91     0.37
## diversification1                        -0.004777   0.030516   -0.16     0.88
## cash1                                   -0.016754   0.024341   -0.69     0.49
## cashn.d.                                -0.002545   0.034259   -0.07     0.94
## ebitda_pos_2020                          0.009654   0.019262    0.50     0.62
## size_revenue                            -0.009890   0.012867   -0.77     0.44
## size_relative                            0.001153   0.001896    0.61     0.54
## revenue_pos_2020                        -0.009149   0.152954   -0.06     0.95
## covid_19:revenue_pos_2020                0.026975   0.090204    0.30     0.77
## covid_19:size_revenue                    0.005472   0.008031    0.68     0.50
## size_revenue:revenue_pos_2020            0.000467   0.019982    0.02     0.98
## covid_19:size_revenue:revenue_pos_2020 -0.004435   0.012212   -0.36     0.72
##
## Residual standard error: 0.0762 on 76 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.0822, Adjusted R-squared:  -0.0627
## F-statistic: 0.567 on 12 and 76 DF,  p-value: 0.861
```

```
mod_10_car2 = lm(car_2~covid_19+diversification+cash+ebitda_pos_2020+size_revenue+size_relative +(covid_
summary(mod_10_car2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + diversification + cash + ebitda_pos_2020 +
##     size_revenue + size_relative + (covid_19 * revenue_pos_2020 *
##     size_revenue), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.1690 -0.0708 -0.0225  0.0569  0.2838
##
## Coefficients:
##                                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)                             -0.069685   0.160581   -0.43     0.67
## covid_19                                 0.010180   0.097361    0.10     0.92
## diversification1                         0.003889   0.044670    0.09     0.93
## cash1                                   -0.043688   0.035631   -1.23     0.22
## cashn.d.                                 0.010619   0.050149    0.21     0.83
## ebitda_pos_2020                          0.026568   0.028197    0.94     0.35
## size_revenue                             0.008699   0.018835    0.46     0.65
## size_relative                           -0.000266   0.002776   -0.10     0.92
## revenue_pos_2020                         0.289279   0.223897    1.29     0.20
## covid_19:revenue_pos_2020               -0.100302   0.132042   -0.76     0.45
## covid_19:size_revenue                    0.000733   0.011755    0.06     0.95
## size_revenue:revenue_pos_2020           -0.028051   0.029250   -0.96     0.34
## covid_19:size_revenue:revenue_pos_2020  0.007054   0.017876    0.39     0.69
##
## Residual standard error: 0.112 on 76 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.12,   Adjusted R-squared:  -0.0187
## F-statistic: 0.865 on 12 and 76 DF,  p-value: 0.585
```

```r
mod_11_car1 = lm(car_1~covid_19+diversification+cash+ebitda_pos_2020+size_revenue+size_relative +(covid_
summary(mod_11_car1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + diversification + cash + ebitda_pos_2020 +
##     size_revenue + size_relative + (covid_19 * p_e_dummy * size_revenue),
##     data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.1253 -0.0494 -0.0047  0.0325  0.1600
##
## Coefficients:
##                                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)                      0.198801   0.143610    1.38    0.171
## covid_19                        -0.092565   0.085811   -1.08    0.285
## diversification1                 0.019267   0.031407    0.61    0.542
## cash1                           -0.051331   0.026510   -1.94    0.057 .
## cashn.d.                        -0.048763   0.036785   -1.33    0.189
## ebitda_pos_2020                  0.009380   0.017066    0.55    0.584
## size_revenue                    -0.014095   0.016532   -0.85    0.397
## size_relative                   -0.000807   0.002085   -0.39    0.700
## p_e_dummy1                      -0.056293   0.165544   -0.34    0.735
## covid_19:p_e_dummy1              0.068935   0.105011    0.66    0.514
## covid_19:size_revenue            0.008622   0.010282    0.84    0.405
## size_revenue:p_e_dummy1          0.007636   0.020966    0.36    0.717
## covid_19:size_revenue:p_e_dummy1 -0.008188   0.013520   -0.61    0.547
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0713 on 67 degrees of freedom
##   (73 observations deleted due to missingness)
## Multiple R-squared:  0.142,  Adjusted R-squared:  -0.0118
## F-statistic: 0.923 on 12 and 67 DF,  p-value: 0.529
```

```r
mod_11_car2 = lm(car_2~covid_19+diversification+cash+ebitda_pos_2020+size_revenue+size_relative +(covid_
summary(mod_11_car2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + diversification + cash + ebitda_pos_2020 +
##     size_revenue + size_relative + (covid_19 * p_e_dummy * size_revenue),
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.19429 -0.06745 -0.00703  0.04979  0.26838
##
## Coefficients:
##                                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)                      0.13180    0.22222    0.59    0.555
```

```
## covid_19                          -0.09406    0.13278   -0.71    0.481
## diversification1                   0.02320    0.04860    0.48    0.635
## cash1                             -0.08402    0.04102   -2.05    0.044 *
## cashn.d.                          -0.05757    0.05692   -1.01    0.315
## ebitda_pos_2020                    0.02817    0.02641    1.07    0.290
## size_revenue                      -0.00737    0.02558   -0.29    0.774
## size_relative                     -0.00373    0.00323   -1.16    0.252
## p_e_dummy1                         0.02295    0.25615    0.09    0.929
## covid_19:p_e_dummy1                0.06170    0.16249    0.38    0.705
## covid_19:size_revenue              0.01055    0.01591    0.66    0.510
## size_revenue:p_e_dummy1            0.00166    0.03244    0.05    0.959
## covid_19:size_revenue:p_e_dummy1 -0.00849    0.02092   -0.41    0.686
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.11 on 67 degrees of freedom
##   (73 observations deleted due to missingness)
## Multiple R-squared:  0.115,  Adjusted R-squared:  -0.0438
## F-statistic: 0.724 on 12 and 67 DF,  p-value: 0.723
```

```
mod_12_car1 = lm(car_1~covid_19+diversification+cross_border+cash+size_relative +(covid_19*cross_border)
summary(mod_12_car1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + diversification + cross_border +
##     cash + size_relative + (covid_19 * cross_border), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.13344 -0.04381 -0.00587  0.02908  0.16779
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)              0.03573    0.04485    0.80     0.43
## covid_19                -0.00301    0.02390   -0.13     0.90
## diversification1         0.00239    0.02923    0.08     0.94
## cross_border1            0.05047    0.05484    0.92     0.36
## cash1                   -0.02039    0.02290   -0.89     0.38
## cashn.d.                -0.00771    0.03380   -0.23     0.82
## size_relative            0.00175    0.00164    1.07     0.29
## covid_19:cross_border1 -0.03074    0.03308   -0.93     0.36
##
## Residual standard error: 0.075 on 81 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.0524, Adjusted R-squared:  -0.0295
## F-statistic: 0.64 on 7 and 81 DF,  p-value: 0.722
```

```
mod_12_car2 = lm(car_2~covid_19+diversification+cross_border+cash+size_relative +(covid_19*cross_border)
summary(mod_12_car2)
```

```
##
## Call:
```

```
## lm(formula = car_2 ~ covid_19 + diversification + cross_border +
##     cash + size_relative + (covid_19 * cross_border), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.1979 -0.0673 -0.0126  0.0496  0.2556
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)              0.03244    0.06742    0.48     0.63
## covid_19                -0.00506    0.03593   -0.14     0.89
## diversification1         0.01011    0.04394    0.23     0.82
## cross_border1            0.03553    0.08244    0.43     0.67
## cash1                   -0.02534    0.03442   -0.74     0.46
## cashn.d.                 0.02877    0.05081    0.57     0.57
## size_relative           -0.00104    0.00247   -0.42     0.68
## covid_19:cross_border1 -0.02227    0.04973   -0.45     0.66
##
## Residual standard error: 0.113 on 81 degrees of freedom
##   (64 observations deleted due to missingness)
## Multiple R-squared:  0.042,  Adjusted R-squared:  -0.0407
## F-statistic: 0.508 on 7 and 81 DF,  p-value: 0.826
```

0.10 cash MOdels

```
cash_CAR1_mod_1 = lm(car_1~covid_19+cash+(covid_19*cash), data = data)
summary(cash_CAR1_mod_1)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + cash + (covid_19 * cash), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.13717 -0.04384 -0.00714  0.02965  0.16854
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)         0.047054   0.059282    0.79     0.43
## covid_19           -0.009243   0.036162   -0.26     0.80
## cash1               0.000556   0.064337    0.01     0.99
## cashn.d.           -0.027882   0.067907   -0.41     0.68
## covid_19:cash1     -0.008724   0.039444   -0.22     0.83
## covid_19:cashn.d. -0.003970   0.041263   -0.10     0.92
##
## Residual standard error: 0.0718 on 147 degrees of freedom
## Multiple R-squared:  0.0406, Adjusted R-squared:  0.00795
## F-statistic: 1.24 on 5 and 147 DF,  p-value: 0.292
```

```
cash_CAR2_mod_1 = lm(car_2~covid_19+cash+(covid_19*cash), data = data)
summary(cash_CAR2_mod_1)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + cash + (covid_19 * cash), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.18902 -0.05914 -0.00371  0.04329  0.27584
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)        0.029656   0.087919    0.34     0.74
## covid_19          -0.014425   0.053630   -0.27     0.79
## cash1             -0.000836   0.095416   -0.01     0.99
## cashn.d.           0.019721   0.100711    0.20     0.85
## covid_19:cash1     0.002519   0.058498    0.04     0.97
## covid_19:cashn.d. -0.016516   0.061195   -0.27     0.79
##
## Residual standard error: 0.106 on 147 degrees of freedom
## Multiple R-squared:  0.0119, Adjusted R-squared:  -0.0217
## F-statistic: 0.354 on 5 and 147 DF,  p-value: 0.879
```

```
cash_CAR1_mod_2 = lm(car_1~covid_19+shares+(covid_19*shares), data = data)
summary(cash_CAR1_mod_2)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + shares + (covid_19 * shares),
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.14599 -0.05221 -0.00447  0.05294  0.15361
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)         0.0718     0.0322    2.23    0.028 *
## covid_19           -0.0452     0.0210   -2.16    0.034 *
## shares1            -0.0427     0.0510   -0.84    0.404
## covid_19:shares1    0.0540     0.0317    1.70    0.092 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0774 on 95 degrees of freedom
##   (54 observations deleted due to missingness)
## Multiple R-squared:  0.0984, Adjusted R-squared:  0.0699
## F-statistic: 3.46 on 3 and 95 DF,  p-value: 0.0195
```

```
cash_CAR2_mod_2 = lm(car_2~covid_19+shares+(covid_19*shares), data = data)
summary(cash_CAR2_mod_2)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + shares + (covid_19 * shares),
```

```
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.18843 -0.06703 -0.00276  0.04767  0.25459
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)       0.03232    0.04648    0.70     0.49
## covid_19         -0.01636    0.03023   -0.54     0.59
## shares1          -0.00538    0.07354   -0.07     0.94
## covid_19:shares1  0.00727    0.04567    0.16     0.87
##
## Residual standard error: 0.112 on 95 degrees of freedom
##   (54 observations deleted due to missingness)
## Multiple R-squared:  0.00413,    Adjusted R-squared:  -0.0273
## F-statistic: 0.131 on 3 and 95 DF,  p-value: 0.941
```

```
cash_CAR1_mod_3 = lm(car_1~covid_19+both+cash+shares+(covid_19*both), data = data)
summary(cash_CAR1_mod_3)
```

```
##
## Call:
## lm(formula = car_1 ~ covid_19 + both + cash + shares + (covid_19 *
##     both), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.1555 -0.0519 -0.0020  0.0510  0.1639
##
## Coefficients: (1 not defined because of singularities)
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.0907     0.0349    2.60    0.011 *
## covid_19        -0.0371     0.0185   -2.00    0.048 *
## both1           -0.0405     0.0582   -0.69    0.489
## cash1           -0.0306     0.0222   -1.38    0.172
## shares1             NA         NA      NA       NA
## covid_19:both1   0.0554     0.0353    1.57    0.120
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0778 on 94 degrees of freedom
##   (54 observations deleted due to missingness)
## Multiple R-squared:  0.0993, Adjusted R-squared:  0.0609
## F-statistic: 2.59 on 4 and 94 DF,  p-value: 0.0416
```

```
cash_CAR2_mod_3 = lm(car_2~covid_19+both+cash+shares+(covid_19*both), data = data)
summary(cash_CAR2_mod_3)
```

```
##
## Call:
## lm(formula = car_2 ~ covid_19 + both + cash + shares + (covid_19 *
##     both), data = data)
```

```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.18666 -0.06886 -0.00256  0.04765  0.26319
##
## Coefficients: (1 not defined because of singularities)
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)     0.032003   0.050346    0.64     0.53
## covid_19       -0.015927   0.026759   -0.60     0.55
## both1          -0.005627   0.084024   -0.07     0.95
## cash1          -0.000311   0.031995   -0.01     0.99
## shares1               NA         NA      NA       NA
## covid_19:both1  0.009375   0.050993    0.18     0.85
##
## Residual standard error: 0.112 on 94 degrees of freedom
##   (54 observations deleted due to missingness)
## Multiple R-squared:  0.00492,    Adjusted R-squared:  -0.0374
## F-statistic: 0.116 on 4 and 94 DF,  p-value: 0.977
```