

MID-TERM REPORT

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1. Literature Review:

1.1. Cash holding:

Cash holding is the amount of cash and cash equivalents held by the company.

Author Komikos and colleagues (2018) with research paper “Corporate Cash Holdings in the Shipping Industry” believes that cash holding is essential to the company because the firm can eliminate the cost of liquidating assets by using the cash held in investment, etc. A. Herlambang (2019) stated that cash holding demonstrates the company’s ability to fulfill its obligations in a timely manner, so cash held is significant for the company.

1.2. Factors affecting the cash holding of the companies:

According to Tim Opler and his colleagues (1999), net working capital has a negative effect on the company’s cash holding, a positive effect with cash flow-to-assets ratio, capital expenditure (CAPEX)-to-assets ratio, industry volatility, and R&D-to-sales ratio. Research paper “The Impact Of Cash Holding On Market Performance Of Listed Firms In The Vietnamese Stock Market” by Do Thi Thanh Nhan, Pham Ha, Ngo Kim Thanh, Pavelkova Drahomira (2017) argues that firm size is inversely proportional to the firm's cash holdings. Attaullah Shah (2011) demonstrates that growing firms, large firms, companies with high cash inflows will have larger cash holdings and companies with faster conversion cycles will have smaller cash holdings. Research “Corporate cash holdings: An empirical investigation of UK companies” (2004) shows that firm leverage is inversely proportional to cash holding, firms with higher leverage will have lower cash holdings. Companies with high leverage will have higher interest costs leading to reduced cash holding capacity.

1.3. Choose variables:

Based on the above researches and the dataset , I will choose two variables as follows:

- Discrete variable: Firm size. I will calculate the size of the given firms based on their total assets. According to Attaullah Shah (2011), size is the natural log to total assets. Then I will classify the firm into big

and small firm. The firm whose size is greater than mean size of the sample data will be assigned as a big firm, the remaining firms will be small firm.

- Continuous variable: Firm leverage. This variable is mentioned in most of the researches.

2. Create the dataset:

My student ID is K194141751, so I will use the last 3 numbers (751) to create my own dataset:

```
# Import data
data = read_excel("040522 Data Mid-term test Final.xlsx")
View(data)
# Create dataset
set.seed(751)
index = sample(1:nrow(data), 100)
index
data_sample = data[index,]
```

Next I will choose the columns that I need for this project:

```
# Choosing columns
data_sample = data_sample[c('no', 'firmcode',
                             'firmname', 'industry',
                             'exchangename', 'totaldebt',
                             'totalasset', 'cash')]
```

Then I will replace NA values in important columns with the median of the corresponding variable:

```
# Replace NA
data_sample['totalasset'][is.na(data_sample['totalasset'])] =
  median(data_sample$totalasset, na.rm = T)
data_sample['cash'][is.na(data_sample['cash'])] =
  median(data_sample$cash, na.rm = T)
data_sample['totaldebt'][is.na(data_sample['totaldebt'])] =
  median(data_sample$totaldebt, na.rm = T)
```

Check the NA remaining on the dataset:

```
> # Check if there is any NA values left in the sample
> sum(is.na(data_sample))
[1] 0
```

The dataset is completely processed.

3. Report:

- 5 firms with highest cash holding:

`Highest Cash Holding Companies`		cash_holding
<chr>		<dbl>
1	BOS Securities JSC	0.725
2	Danang Housing Investment Development JSC	0.654
3	Safoco Foodstuff JSC	0.589
4	Noibai Cargo Terminal Services JSC	0.525
5	Clever Group Corp	0.524

The company with the highest cash holding in the data set is BOS Securities JSC with 0.725 (72.5%). Followed by Danang Housing Investment Development JSC with 0.654 (65.4%).

- 5 firms with lowest cash holding:

`Lowest Cash Holding Companies`		cash_holding
<chr>		<dbl>
1	Southeast Asia Commercial Joint Stock Bank	0.000420
2	BaoViet Holdings	0.000525
3	Vinacomin NuiBeo Coal JSC	0.000891
4	National Citizen Commercial Joint Stock Bank	0.00121
5	Hoang Minh Finance Investment JSC	0.00296

The company with the lowest cash holding in the data set is Southeast Asia Commercial Joint Stock Bank with 0.000420 (0.042%). Followed by BaoViet Holdings with 0.000525 (0.0525%).

- The name of industries which the firms belong to:

```
> print(paste("All industry names"))
[1] "All industry names"
> unique(data_sample$industry)
[1] "Industrials"      "Real Estate"
[3] "Basic Materials"  "Healthcare"
[5] "Technology"       "Energy"
[7] "Consumer Cyclical" "Utilities"
[9] "Consumer Non-Cyclical" "Financials"
```

There are 10 industry names in the dataset.

For the top highest cash holding:

"Highest Cash Holding Companies"	industry
<chr>	<chr>
1 BOS Securities JSC	Financials
2 Danang Housing Investment Development JSC	Real Estate
3 Safoco Foodstuff JSC	Consumer Non-Cyclicals
4 Noibai Cargo Terminal Services JSC	Industrials
5 Clever Group Corp	Consumer Cyclicals

5 highest cash holdings represent 5 different industries.

For the top lowest cash holding:

"Lowest Cash Holding Companies"	industry
<chr>	<chr>
1 Southeast Asia Commercial Joint Stock Bank	Financials
2 BaoViet Holdings	Financials
3 Vinacomin NuiBeo Coal JSC	Energy
4 National Citizen Commercial Joint Stock Bank	Financials
5 Hoang Minh Finance Investment JSC	Real Estate

Financials firms make up the majority of this list, which means that Financials firms tend to have low cash holding.

- Provide descriptive statistics with median, mean, max, min, standard deviation of cash holding of:

- Different categories of the discrete variable:

```
# Different categories of the discrete variable
mean_firm_size = mean(data_sample.firm_size)
data_sample$class_firm_size = data_sample.firm_size > mean_firm_size
data_sample$class_firm_size = replace(data_sample$class_firm_size, data_sample$class_firm_size == "TRUE", "LARGE")
data_sample$class_firm_size = replace(data_sample$class_firm_size, data_sample$class_firm_size == "FALSE", "SMALL")
View(data_sample)
discrete_stats = data_sample %>%
  group_by(class_firm_size) %>%
  summarise(
    median_cashholding = median(cash_holding),
    mean_cashholding = mean(cash_holding),
    max_cashholding = max(cash_holding),
    min_cashholding = min(cash_holding),
    sd_cashholding = sd(cash_holding)
  )
```

	CASH HOLDING				
FIRM SIZE	MEDIAN	MEAN	MAX	MIN	STANDARD DEVIATION
LARGE	0.1337084	0.1600640	0.6536302	0.0004201619	0.1510829
SMALL	0.0916340	0.1515661	0.7246039	0.0029564278	0.1672304

It can be seen from the above table that the mean cash holding of large firms is greater than that of the small firms, which means that the large firms tends to have higher cash holding. This is contradict with the literature review because Pavelkova Drahomira (2017) argues that firm size is inversely proportional to the firm's cash holdings. But it is not a big problem because this dataset contains just 100 randomly selected companies.

Moreover, the min, max and standard deviation of cash holding of small companies is greater than those of large firms. It means that almost all small firms have low cash holding but there are some small firms have unusual high cash holding. This leads to high standard deviation. So the stats do not totally contradict with the literature review.

- Groups of above/below median of the continuous variable:

```
# Groups of above/below median of the continuous variable
med_leverage = median(data_sample$leverage)
med_leverage
data_sample$class_leverage = data_sample$leverage > med_leverage

data_sample$class_leverage = replace(data_sample$class_leverage, data_sample$class_leverage == 'TRUE', 'HIGH')
data_sample$class_leverage = replace(data_sample$class_leverage, data_sample$class_leverage == 'FALSE', 'LOW')

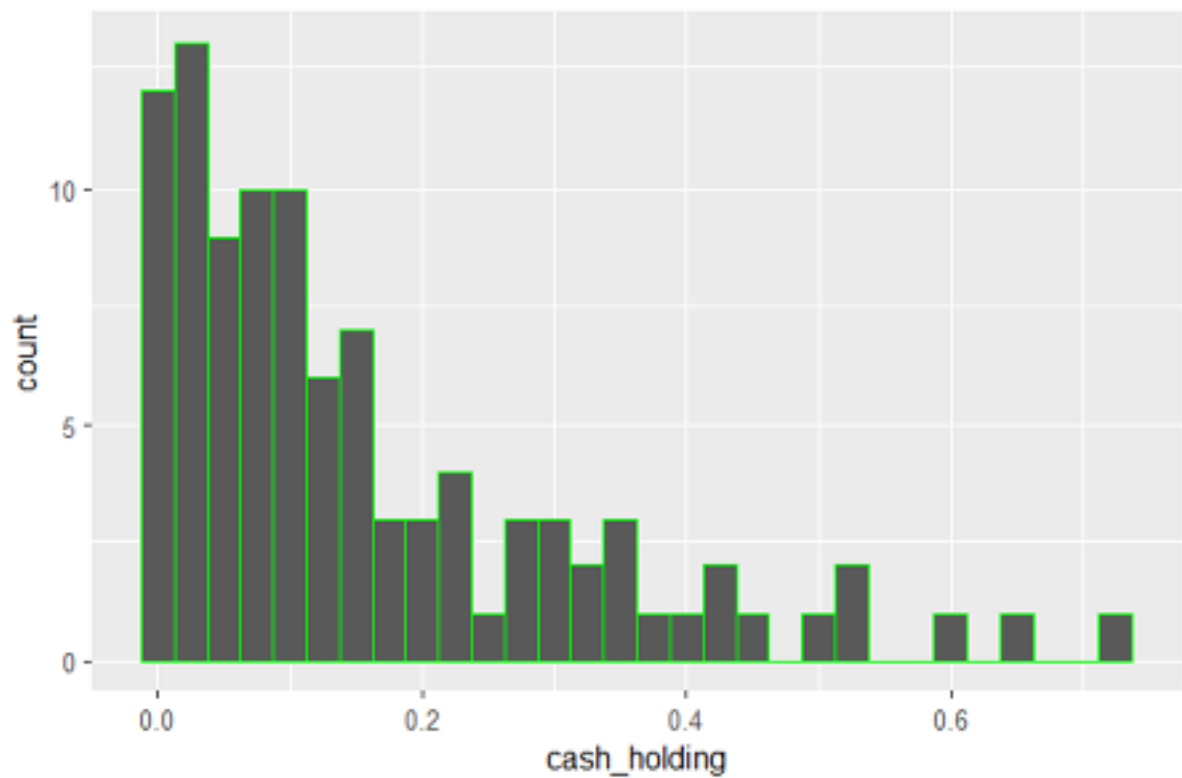
continuous_stats = data_sample %>%
  group_by(class_leverage) %>%
  summarise(median_cashholding = median(cash_holding),
            mean_cashholding = mean(cash_holding),
            max_cashholding = max(cash_holding),
            min_cashholding = min(cash_holding),
            sd_cashholding = sd(cash_holding))
```

	CASH HOLDING				
COMPARE TO MEDIAN OF LEVERAGE	MEDIAN	MEAN	MAX	MIN	STANDARD DEVIATION
HIGH	0.07057448	0.1263301	0.5241252	0.0004201619	0.1363769
LOW	0.12963046	0.1849601	0.7246039	0.0005246654	0.1751746

All indicators of firms with higher leverage (compared to median) are lower than those of lower leverage firms. We can conclude that firms with higher leverage will have lower cash holding. This is perfectly matched with the literature review.

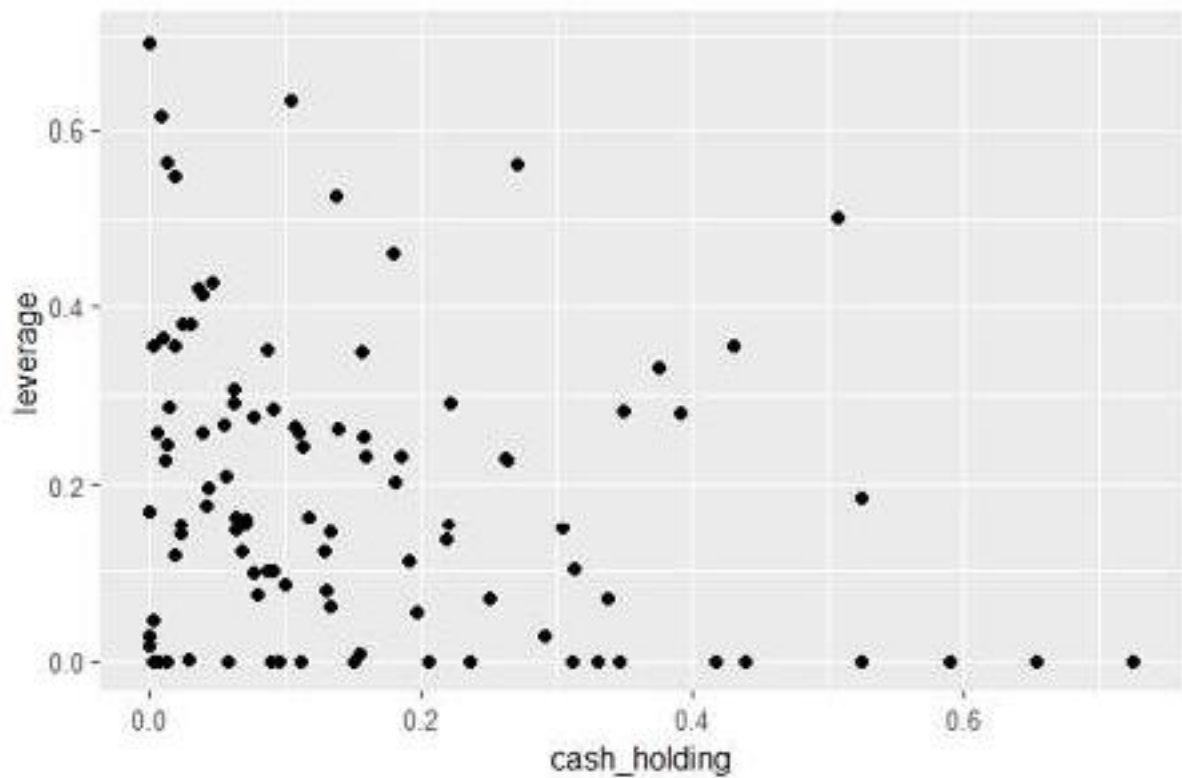
4. Data visualization:

4.1. provide histogram of cash holding:

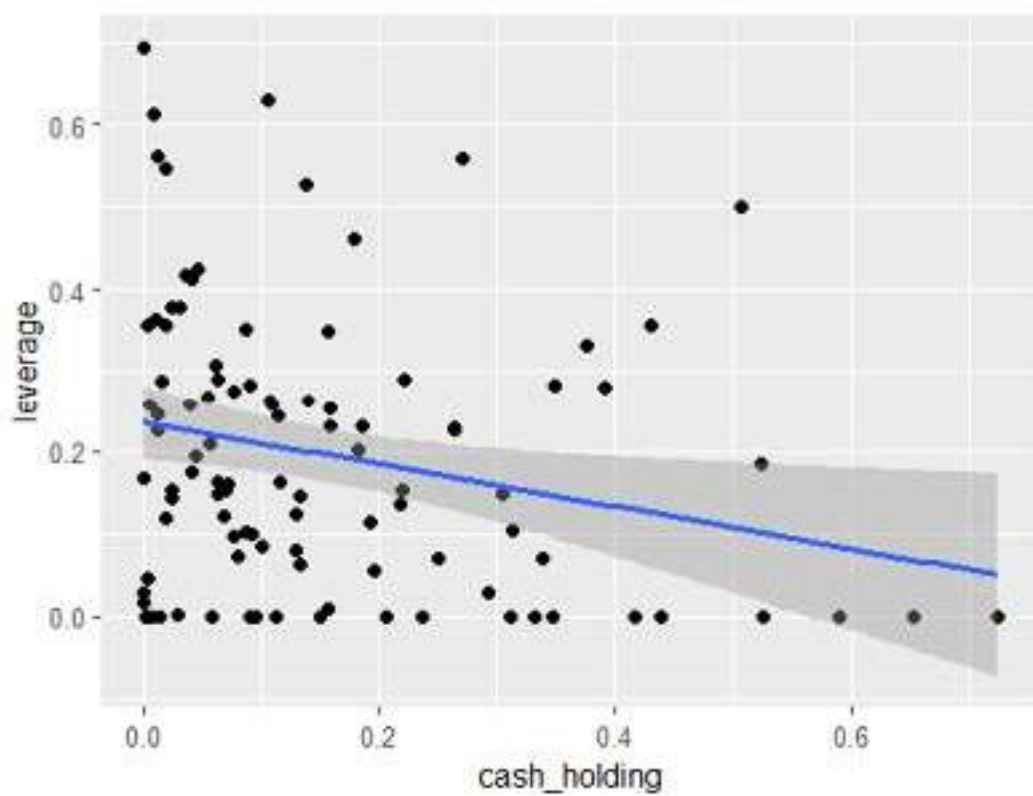


The distribution of cash holdings is skewed to the left as most companies have cash holding ratios in the range of 0 - 0.2.

4.2. provide scatter plot of cash holding with the continuous variable:

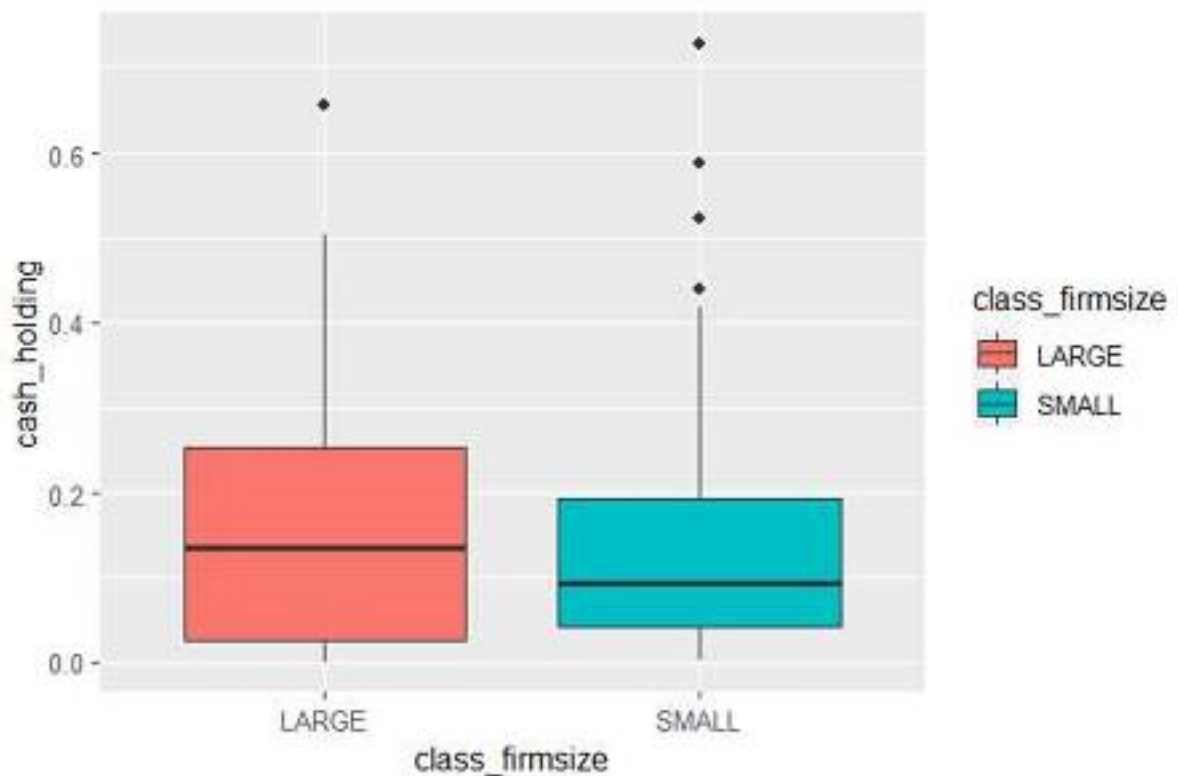


We can see that the data points are distributed quite messy. It is really hard to make any conclusion from this plot. So let's add the trend line of those points.



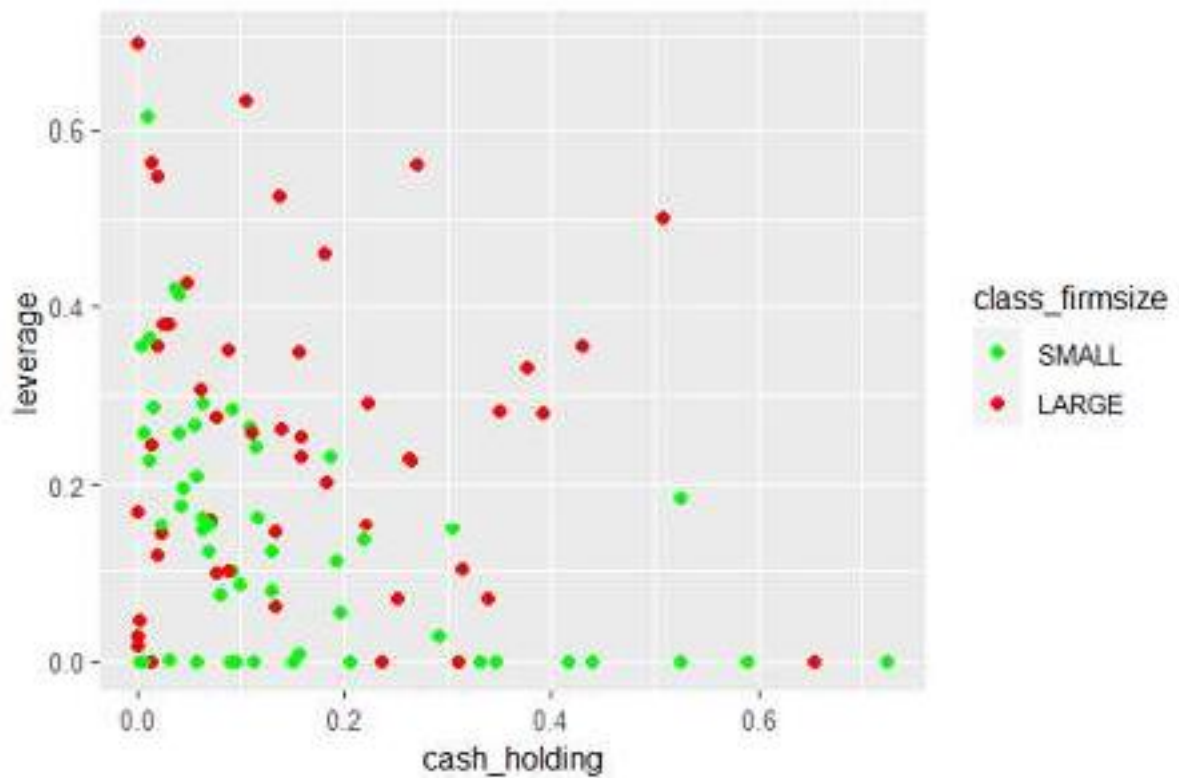
We can see that the trend line's slope is negative, which means that leverage has a negative effect on the company's cash holding. This also matches with the literature review.

4.3. Provide boxplot of cash holding with the discrete variable (different colour for different categories of discrete variable):

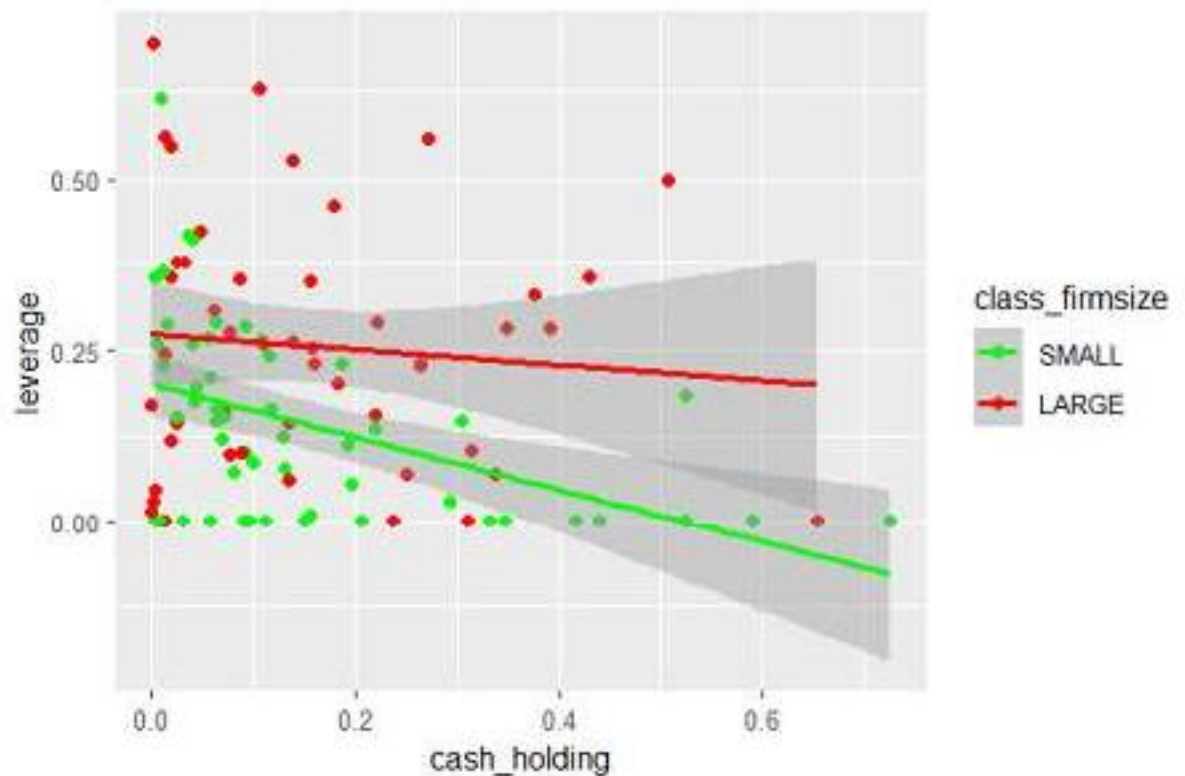


As I mentioned above, some small firms have unusual high cash holding. We can clearly see 4 outliers in the box plot of small firms. Small firms' cash holding median is lower than that of the large firms, this is consistent with my statement above: "almost all small firms have low cash holding but there are some small firms have unusual high cash holding".

4.4. Provide a plot that allow the combination of continuous, discrete variables and cash holding:



This is a plot quite similar to the plot in section 4.2, except that the data points are colored to distinguish between large companies and small companies. To comment on the correlation between leverage and cash holding variables according to the size of the firm, 2 trend lines will be added corresponding to 2 firm sizes.



Looking at the chart, the red line depicts the trend of the data points of large companies, while the green line depicts the small companies. It can be seen that both of these trend lines show a negative correlation between the cash holding and leverage variables, however the green line is steeper than the red line. This means that in small firms, leverage has a stronger negative correlation with cash holding.

5. Using LOOP:

- Count the number of firms in an industry (if you are given an industry name, you can count the number of firms in that industry)

```
> # Count the number of firms in an industry
> input = 'Healthcare'
> count = 0
> for (i in 1:nrow(data_sample)) {
+   if (data_sample[i,4] == input){
+     count = count + 1
+   }
+ }
> print(paste(input, ': ', count, 'firm(s)'))
[1] "Healthcare : 5 firm(s)"
```

It can be seen from the code and the output that when we assign a specific industry name to the input variable, the code will output the number of firms corresponding to the industry name. For example, it can be seen from the above image that there are 5 firms in the Healthcare industry.

- Count the number of firms in an industry and with cash holding above a certain value (if you are given an industry name and a specific value of cash holding, you can count the number of firms in that industry and above that certain value):

```
> # Count the number of firms in an industry and with cash holding above a certain
value
> input = 'Financials'
> count = 0
> threshold = 0.3
> for (i in 1:nrow(data_sample)) {
+   if (data_sample[i,4] == input & data_sample[i,2] > threshold){
+     count = count + 1
+   }
+ }
> print(paste(input, 'firm(s) with cash holding ratio greater than', threshold, ': ', c
ount))
[1] "Financials firm(s) with cash holding ratio greater than 0.3 : 3"
```

It can be seen from the code and the output that when we assign a specific industry name to the input variable and a certain value to the threshold variable, the code will output the number of firms whose cash holding is greater than the threshold corresponding to the industry name. For example, it can be seen from the above image that there are 3 firms in the Financials industry whose cash holding is greater than 0.3.

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