Designated Market Makers

November 24, 2021

1 Distribution Comparison

Look at using R to calculate some results in Skjeltorp and Ødegaard (2015)

The paper investigates how a *Designated Market Maker* at the OSE influences trading on the exhange.

One experiment is to compare the *relative spread* before and after a firm hires a DMM.

Comparison is done two ways:

- Compare the *distribution* of the spread by means of histograms.
- Test for difference in means across two groups.

Data provided as two text files with observations for each group:

file:`year_before_first_dmm.txt`

```
0.0106056
0.0242492
0.0511783
0.0193352
....
```

file: `year_after_first_ dmm.txt`

```
0.0103177
0.0167199
0.0211568
0.018394
...
```

Will show what you do in `R` to perform these two statistical analyses

First read in the two series:

```
> SpreadsYearBefore <- read.table("../data/year_before_first_dmm.txt")
> SpreadsYearAfter <- read.table("../data/year_after_first_dmm.txt")
```

Now want to produce histograms useful for comparing the two distributions. Need to specify that they should be plotted on the same axes. Done by plotting from zero to the max of the two, adding a bit (0.01) to round up.

```
> mx <- max(SpreadsYearBefore$V1, SpreadsYearAfter$V1)+0.01
> postscript("../plots/hist_year_before_first_dmm.eps",
+            horizontal=FALSE,width=10,height=5)
> hist(SpreadsYearBefore$V1,main="",plot=TRUE,
+      freq=TRUE,xlim=c(0,mx),density=8,xlab="Spread")
```

Note the typical way things are done in R: Specifying a lot of options when doing the call. One of them is the axes: (

```
xlim=c(0,mx)
```

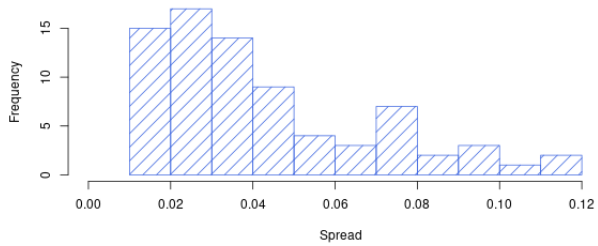
)

When doing the plot for the year after, specify same axes.

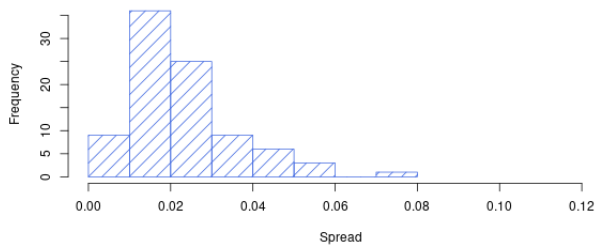
```
> postscript("../plots/hist_year_after_first_dmm.eps",
+            horizontal=FALSE,width=10,height=5)
> hist(SpreadsYearAfter$V1,main="",plot=TRUE,freq=TRUE,
+      xlim=c(0,mx),density=8,xlab="Spread")
```

Let us now look at the two pictures.

Year before:



Year after:



1.1 Formal testing for differences

Testing formally for whether there is a difference before and after can for example be done as a test of whether the mean has changed between the two dates.

This is done by a t-test for difference in means, the R command `t.test`.

Let us first look at the case with a two sided test, shown below

```
> t.test(SpreadsYearBefore$V1,SpreadsYearAfter$V1,
+        alternative="two.sided",paired=FALSE)
Welch Two Sample t-test
data:  SpreadsYearBefore$V1 and SpreadsYearAfter$V1
t = 5.7612, df = 106.836, p-value = 8.143e-08
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.01245916 0.02553181
sample estimates:
 mean of x  mean of y
0.04198414 0.02298865
```

We reject equality of means.

Now, it is not obvious that we should use a two sided test, this may actually be argued to be a one-sided test, since it is hard to believe that liquidity *worsens* when a DMM is hired.

Then we need to specify that the alternative hypothesis is that the mean is *greater* afterwards

```
> t.test(SpreadsYearBefore$V1,SpreadsYearAfter$V1,
+        alternative="greater")

Welch Two Sample t-test

data:  SpreadsYearBefore$V1 and SpreadsYearAfter$V1
t = 5.7612, df = 106.836, p-value = 4.072e-08
alternative hypothesis: true difference in means is greater than 0
95 percent confidence interval:
 0.01352472        Inf
sample estimates:
 mean of x  mean of y
0.04198414 0.02298865
```

Now, be careful here, it is easy to take the wrong direction with a one sided test, as shown below

```
> t.test(SpreadsYearBefore$V1,SpreadsYearAfter$V1,
+        alternative="less")

Welch Two Sample t-test

data:  SpreadsYearBefore$V1 and SpreadsYearAfter$V1
t = 5.7612, df = 106.836, p-value = 1
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
       -Inf 0.02446625
sample estimates:
 mean of x  mean of y
0.04198414 0.02298865
```

Just to make a further illustration of the types of additional specifications one can put on the statistics in R:

One can assume that the two groups are sampled from the same distribution, and specify that they have the same mean:

```
> t.test(SpreadsYearBefore$V1,SpreadsYearAfter$V1,
+        alternative="two.sided",var.equal=TRUE)

Two Sample t-test

data:  SpreadsYearBefore$V1 and SpreadsYearAfter$V1
t = 6.0242, df = 164, p-value = 1.083e-08
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.01276936 0.02522161
sample estimates:
 mean of x  mean of y
0.04198414 0.02298865
```

References

Johannes Skjeltorp and Bernt Arne Ødegaard. Why do listed firms pay for market making in their own stock? *Financial Management*, pages 241–261, Summer 2015.