

Designated Market Makers

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 exchange.

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

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

...

Read data

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")  
> SpreadsYearAfter <- read.table("../data/year_after_first_dmm.t")
```

Produce histograms

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)`

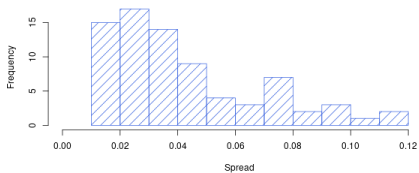
Histograms ctd

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

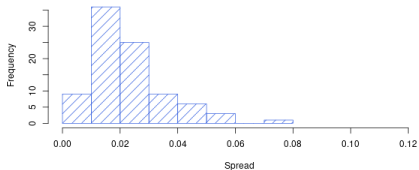
```
> postscript("../plots/hist_year_after_first_dmm.eps",  
+           horizontal=FALSE,width=10,height=5)  
> hist(SpreadsYearAfter$V1,main="",plot=TRUE,freq=TRUE,  
+      xlim=c(0,mx),density=8,xlab="Spread")
```

Comparing the distributions

Year before:



Year after:



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`.

Formal testing for differences ctd

Case with a two sided test

```
> 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.

Formal testing for differences

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
```

```
95 percent confidence interval:
```

```
0.01352472      Inf
```

```
sample estimates:
```

```
mean of x mean of y
```

```
0.04198414 0.02298865
```

Formal testing for differences ctd

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
```

Formal testing for differences ctd

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 variance, by the specification `var.equal=TRUE`:

```
> 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

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