QMB Exercise 1 - Exploring Housing Rents

Dino Nienhold

Wednesday, February 19, 2015

Introduction

The following report is based on the QMB Exercise 1 - Exploring Housing Rents. The task description pdf file is bis_ex1-HousingRents.pdf

Requirements

Please make sure that you the following packages loaded in your workspace.

```
library("dplyr")
```

```
##
## Attaching package: 'dplyr'
##
## The following object is masked from 'package:stats':
##
##     filter
##
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library("ggplot2")
```

Data Set

Please make sure you have the file housingrents.csv in the subdirectoy Data in your workspace.

```
housingrents <- read.csv("./Data/housingrents.csv",sep=";")
```

Task 1

There are 152 observations and 7 variables in the dataset (Use `dim(housingrents)`). The str command gives an overview of the variable types:

```
str(housingrents)
```

```
## 'data.frame':    152 obs. of  7 variables:
##  $ id     : int  1 2 3 4 6 7 8 10 11 13 ...
##  $ rooms  : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ area   : int  34 35 50 45 35 40 43 45 37 60 ...
##  $ rent   : int  310 749 281 483 515 530 480 560 580 510 ...
##  $ nre    : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ econage: int  24 40 34 30 27 31 30 28 50 42 ...
##  $ balcony: Factor w/ 2 levels "no","yes": 2 1 2 1 1 NA 1 1 1 1 ...
```

There are 14 NA values in the balcony variable.

```
summary(housingrents)
```

```
##        id             rooms            area             rent
##  Min.   :  1.00   Min.   :1.000   Min.   : 18.00   Min.   : 250.0
##  1st Qu.: 38.75   1st Qu.:2.000   1st Qu.: 60.00   1st Qu.: 793.8
##  Median : 76.50   Median :3.000   Median : 83.00   Median :1046.0
##  Mean   : 76.50   Mean   :3.171   Mean   : 86.84   Mean   :1240.3
##  3rd Qu.:114.25   3rd Qu.:4.000   3rd Qu.:105.00   3rd Qu.:1552.8
##  Max.   :152.00   Max.   :6.000   Max.   :250.00   Max.   :4725.0
##       nre            econage      balcony
##  Min.   :0.0000   Min.   : 0.00   no  :61
##  1st Qu.:0.0000   1st Qu.:22.00   yes :77
##  Median :0.0000   Median :31.00   NA's:14
##  Mean   :0.3355   Mean   :30.18
##  3rd Qu.:1.0000   3rd Qu.:39.00
##  Max.   :1.0000   Max.   :60.00
```

Task 2

Data Processing

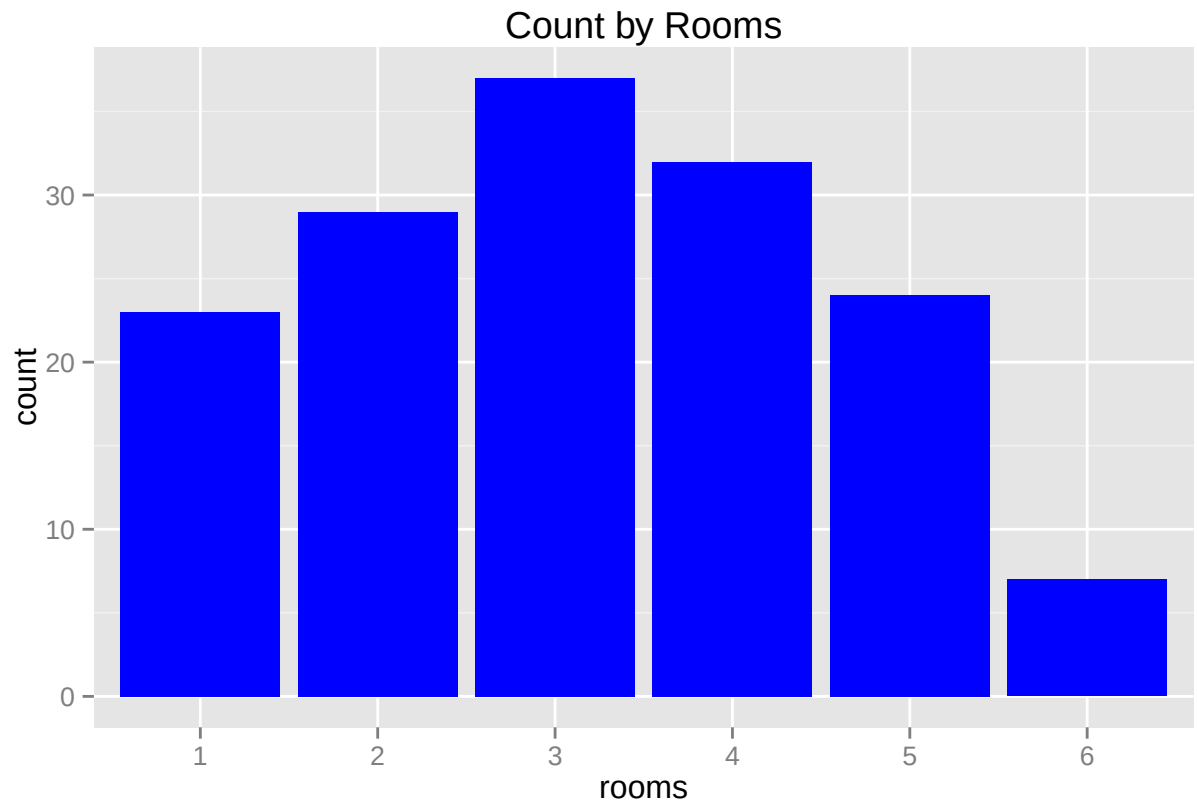
For analysis purposes it is necessary to convert the rooms and nre variable to a factor.

```
housingrents <- mutate(housingrents, rooms = factor(rooms),
  nre = factor(nre,levels=c(0,1),labels=c("no","yes")))
```

Plotting

The following chart shows the frequency of appartments according to their numberof rooms.

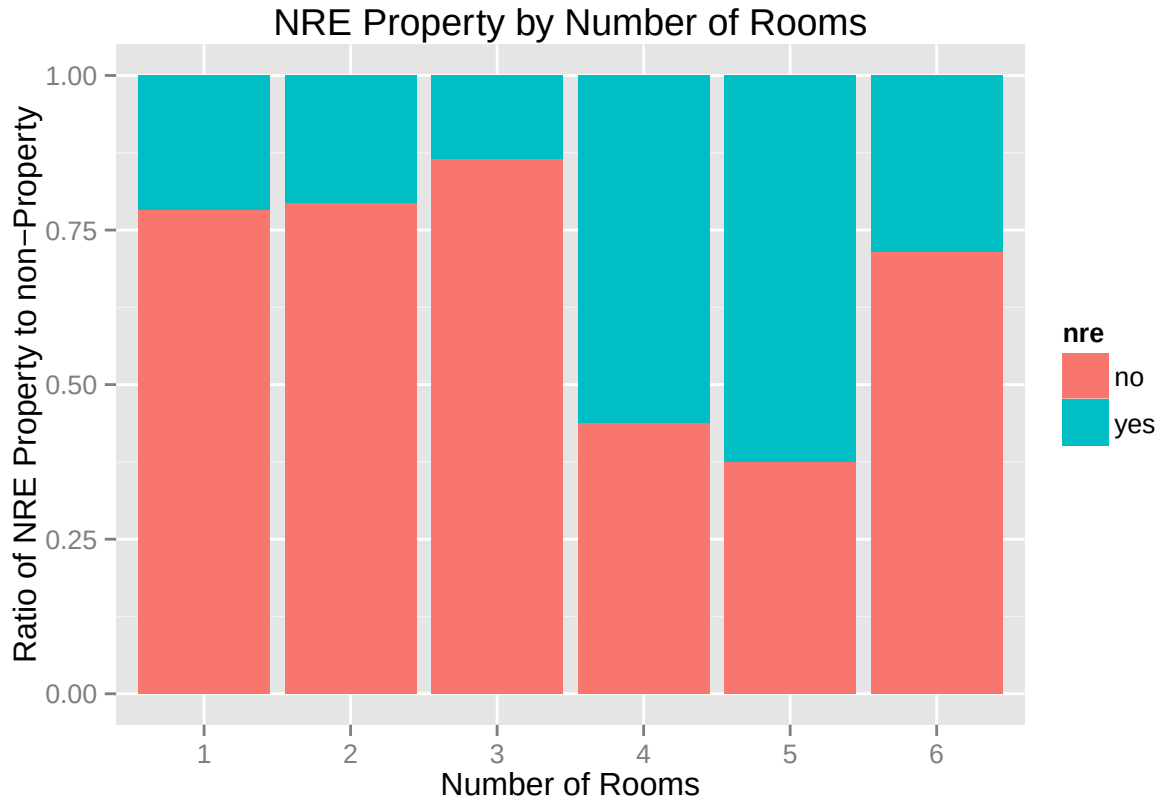
```
ggplot(data=housingrents, aes(x=rooms,label=rooms))  +
  geom_bar(fill="blue") +
  ggtitle("Count by Rooms")
```



Task 3

In this section the contingency table for rooms and nre are calculated and plotted.

```
rooms2nre <- xtabs(~rooms+nre, data=housingrents)
rooms2nre <- prop.table(rooms2nre,1)
ggplot(data.frame(rooms2nre), aes(x=rooms, y=Freq, fill=nre)) +
  geom_bar(stat="identity") +
  xlab("Number of Rooms") +
  ylab("Ratio of NRE Property to non-Property") +
  ggtitle("NRE Property by Number of Rooms")
```



Contingency Table with row percentages

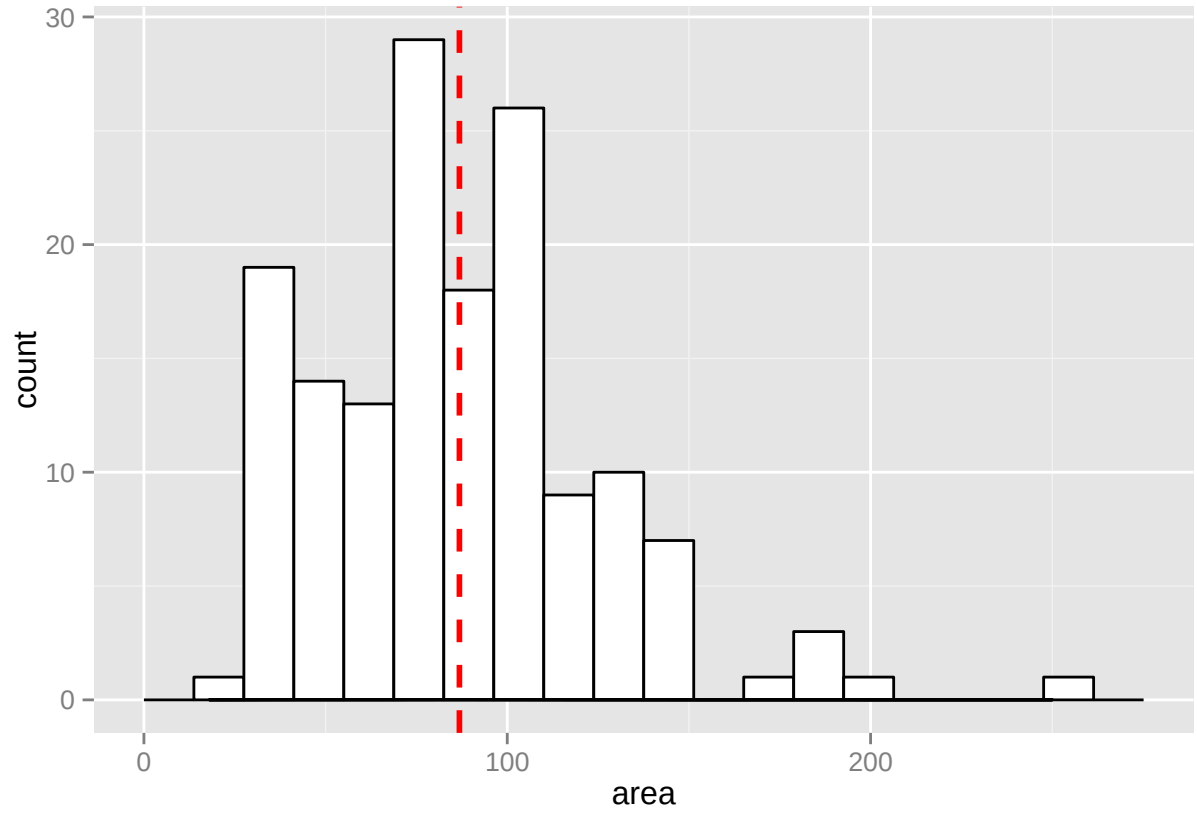
```
addmargins(prop.table(rooms2nre,1))
```

```
##      nre
## rooms        no       yes       Sum
##   1   0.7826087 0.2173913 1.0000000
##   2   0.7931034 0.2068966 1.0000000
##   3   0.8648649 0.1351351 1.0000000
##   4   0.4375000 0.5625000 1.0000000
##   5   0.3750000 0.6250000 1.0000000
##   6   0.7142857 0.2857143 1.0000000
##   Sum 3.9673627 2.0326373 6.0000000
```

Task 4

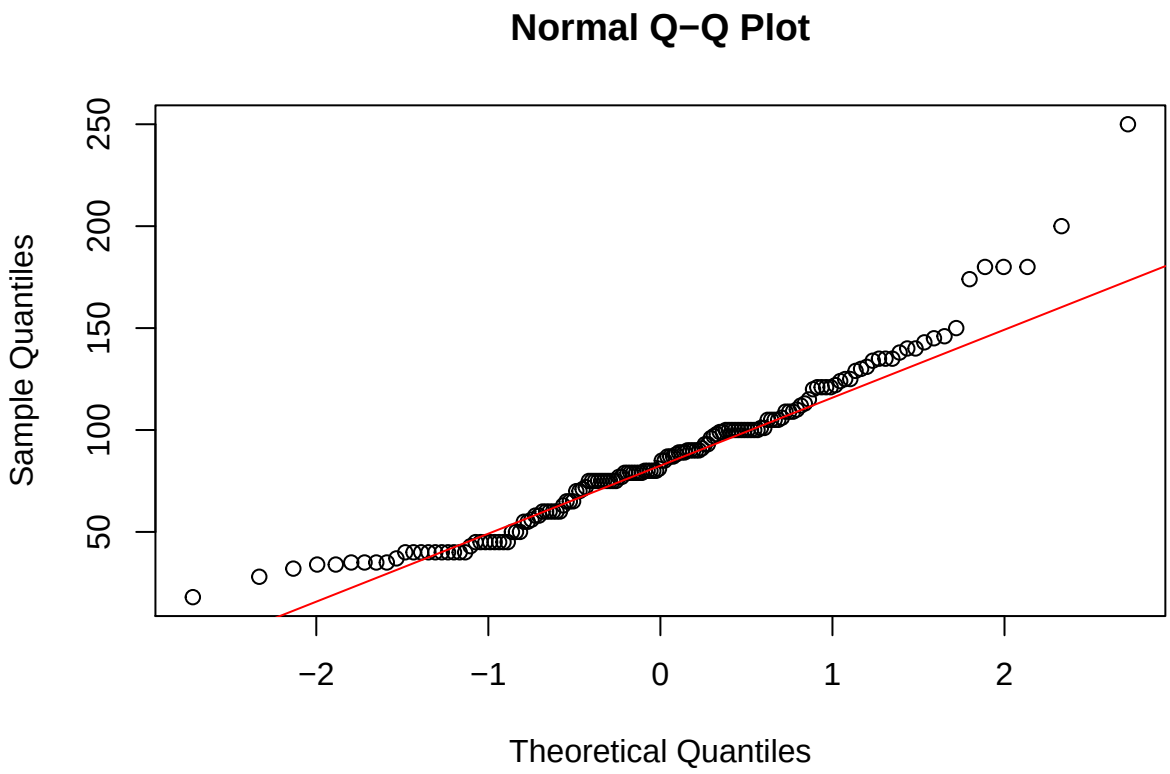
In this section the distribution of the variable area is analyzed to see if it is normally distributed.

```
#Calculate binwidth based on the Freedman-Diaconis rule
bw <- diff(range(housingrents$area)) / (2 * IQR(housingrents$area) /
  length(housingrents$area)^(1/3))
#Plot the histogram
g <- ggplot(housingrents, aes(x = area)) +
  geom_histogram(binwidth = bw,colour="black", fill="white")  +
  geom_density(alpha=.2) +
  geom_density(alpha=.5, fill="#FF6666") +
  geom_vline(aes(xintercept=mean(area, na.rm=T)),
  color="red", linetype="dashed", size=1)
print(g)
```



The qqplot should to get a better understanding.

```
qqnorm(housingrents$area);qqline(housingrents$area, col = 2)
```



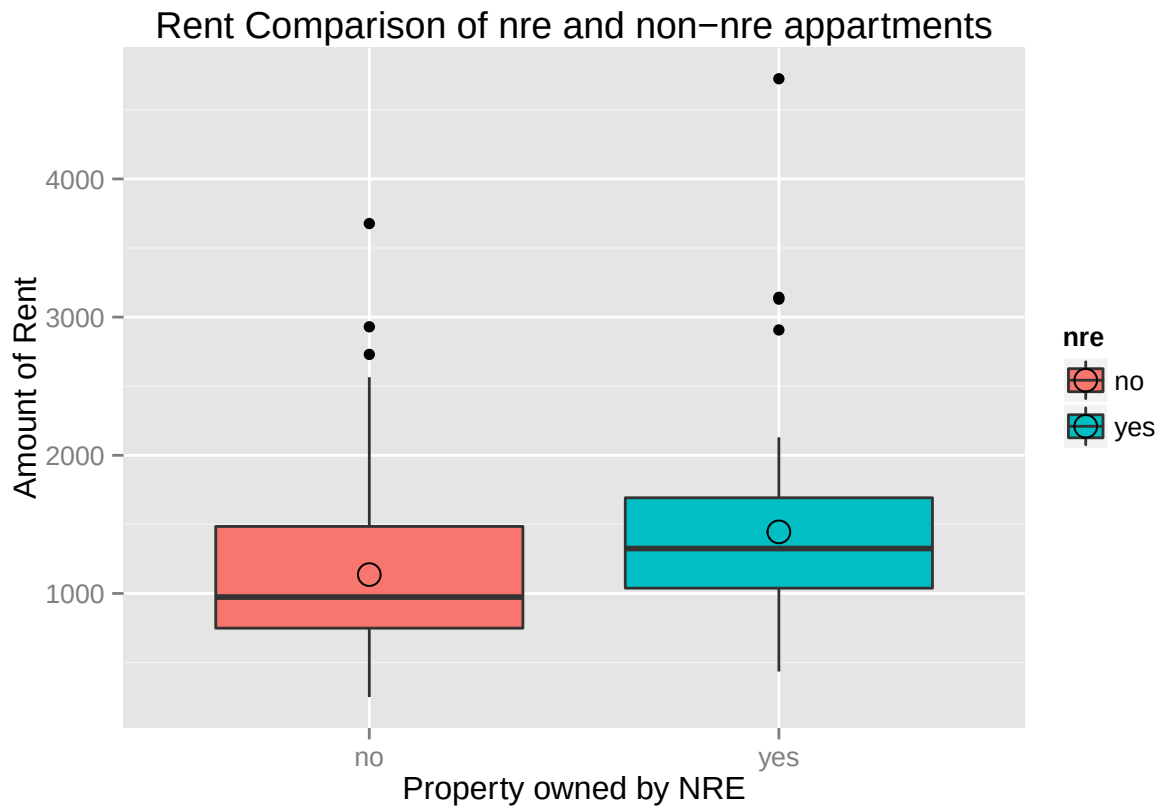
Conclusion

The area variable is normally distributed.

Task 5

In this section the mean/median of the rent of NRE and non-NRE appartments are compared

```
ggplot(housingrents,aes(y=rent,x=nre, fill=nre)) +
  geom_boxplot()  +
  stat_summary(fun.y=mean, geom="point", shape=1, size=4) +
  xlab("Property owned by NRE") +
  ylab("Amount of Rent") +
  ggtitle("Rent Comparison of nre and non-nre appartments")
```



The following table shows the mean and median rent by nre and non-nre appartments:

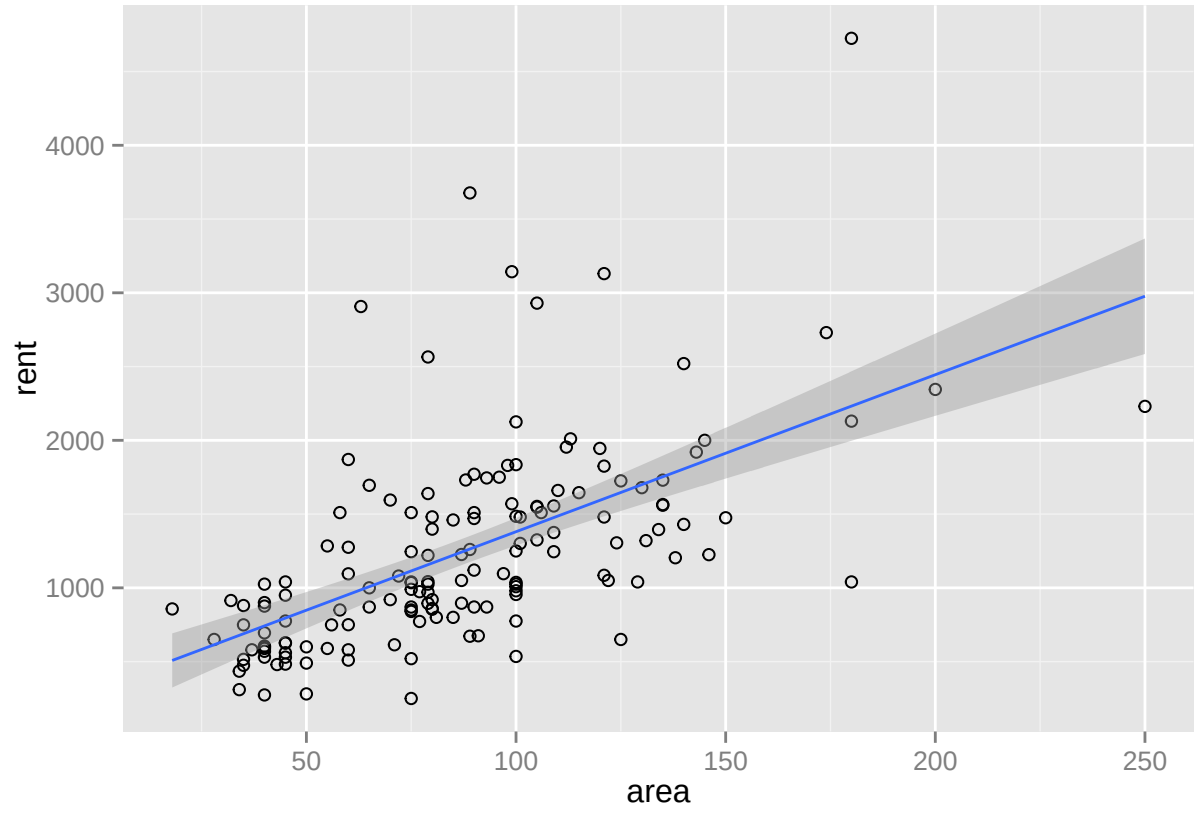
```
select(housingrents,rent,nre) %>%
  group_by(nre) %>%
  summarise(mean = mean(rent), median = median(rent) )
```

```
## Source: local data frame [2 x 3]
##
##   nre     mean median
## 1  no 1136.584    974
## 2 yes 1445.745   1325
```

Task 6

This sections shows that the variables rent and the area are correlated.

```
ggplot(housingrents, aes(x=area, y=rent)) +
    geom_point(shape=1) +  geom_smooth(method=lm)
```



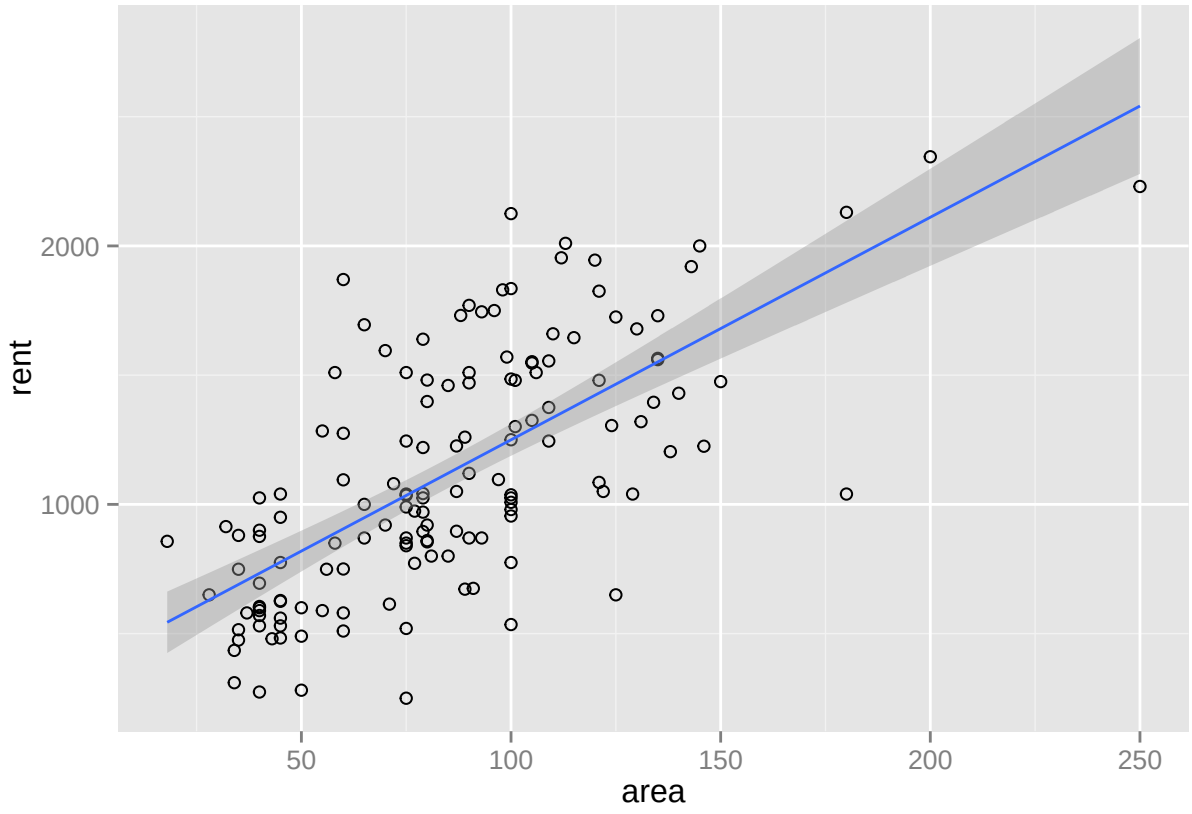
The outliers are appartmentswith a high rent >2500

```
filter(housingrents, rent > 2500)
```

```
##    id rooms area rent nre econage balcony
## 1  60     3   79 2565  no      43      no
## 2  64     3   63 2907 yes      13      no
## 3  98     4   89 3677  no       0     yes
## 4 102     4   99 3143 yes      19    <NA>
## 5 119     4  105 2930  no      12     yes
## 6 125     5  174 2730  no       4     yes
## 7 141     5  140 2520  no      10     yes
## 8 142     5  121 3130 yes      33     yes
## 9 151     6  180 4725 yes      24      no
```

Without the outliers their is a stronger correlation between the rent and the area.

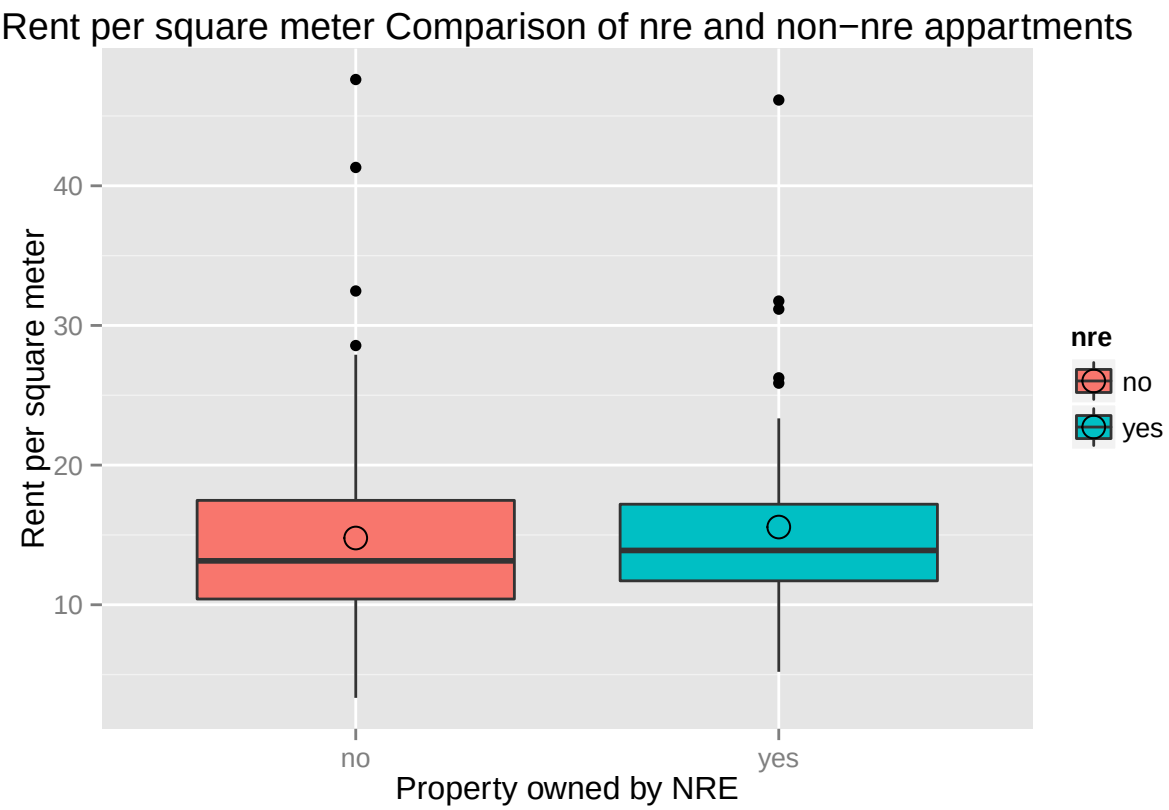
```
ggplot(filter(housingrents, rent <= 2500 ), aes(x=area, y=rent)) +
    geom_point(shape=1) +  geom_smooth(method=lm)
```



Task 7

In this section the rent per square meter by nre and non-nre apartments are analyzed.

```
#Create new variable rps (rent per squre meter
housingrents <- mutate(housingrents,rps = rent/area)
ggplot(housingrents,aes(y=rps,x=nre, fill=nre)) +
  geom_boxplot()  +
  stat_summary(fun.y=mean, geom="point", shape=1, size=4) +
  xlab("Property owned by NRE") +
  ylab("Rent per square meter") +
  ggtitle("Rent per square meter Comparison of nre and non-nre appartments")
```



The following table shows the mean and median rent per square meter by nre and non-nre appartments:

```
select(housingrents,rps,nre) %>%
  group_by(nre) %>%
  summarise(mean = mean(rps), median = median(rps) )
```

```
## Source: local data frame [2 x 3]
##
##   nre     mean   median
## 1  no 14.77912 13.14286
## 2 yes 15.56434 13.88889
```

Conclusion

The table shows that nre are only slightly more expensive when measured by rent per square meter.