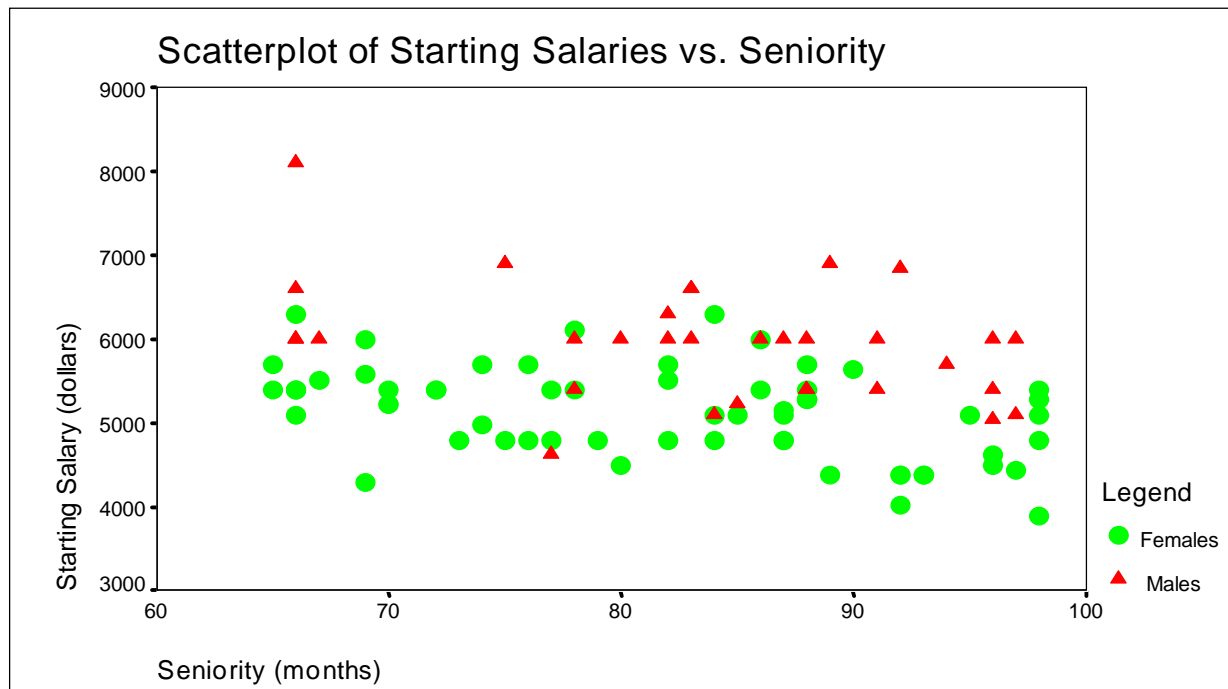


SEX DISCRIMINATION PROBLEM

6. Displaying Relationships between Variables

- 6.1 Did the bank pay higher starting salaries to men than to women hired at the same time?
- 6.2 Did the bank pay higher starting salaries to men than to women with approximately the same previous experience?
- 6.3 Did the women tend to receive lower starting salaries than similarly educated men?
- 6.4 Did the older employees tend to receive lower starting salaries?
- 6.5 Did the bank pay higher salaries in 1977 to men than to women with the same seniority?
- 6.6 Did females tend to receive smaller pay increases than similarly experienced (in terms of seniority) males during their employment with the bank?
- 6.7 Scatterplot matrix
- 6.8 3-D scatterplot of starting salaries versus number of years of education, prior experience, and seniority.

- 6.1 Did the bank pay higher starting salaries to men than to women hired at the same time? In order to answer the question, we will obtain a scatterplot of starting salaries versus seniority for males and females. Plotting salaries against seniority ensures that we will be able to compare the salaries for both gender groups hired at the same time. We will use different marking symbol in the plot to denote male and female subjects.



As you can see the starting salaries of males tend to be higher than the salaries of females hired at the same time. No matter when the clerks have been employed, the highest paid employees are males. The situation has not improved for those hired at the end of the three-year period (low seniority), even it has worsened because almost all new male employees get higher salaries than the females. The plot indicates increasing disparity over the considered period.

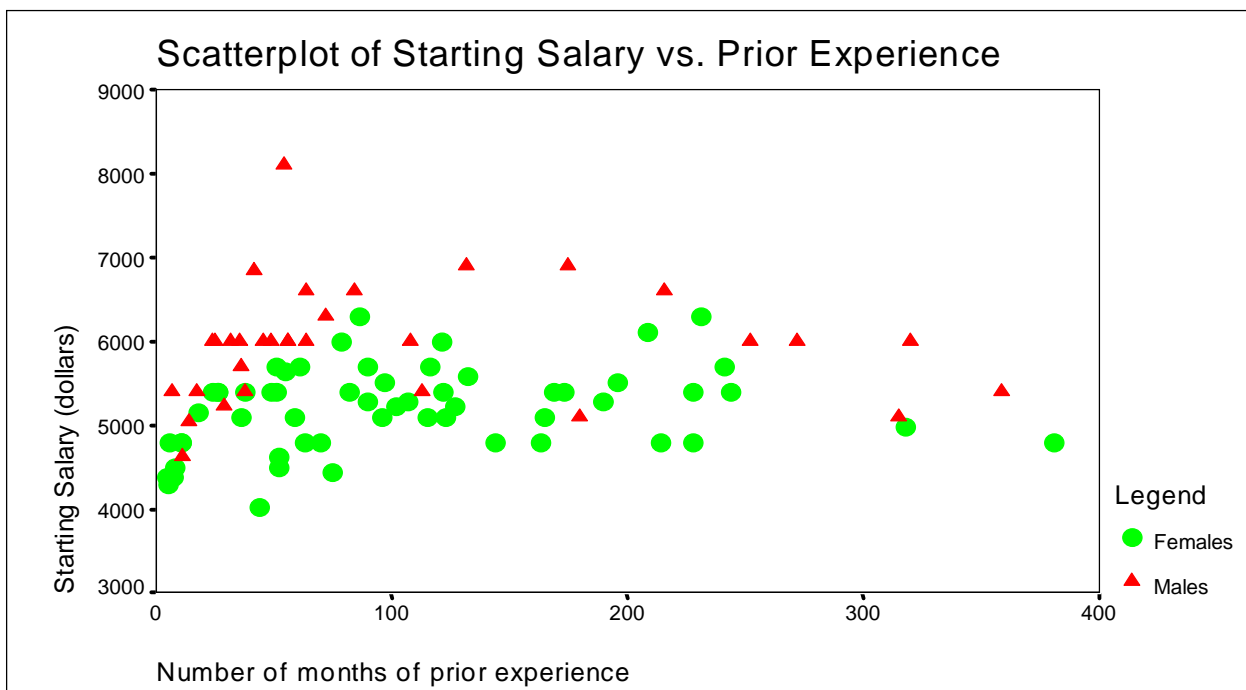
A slow upward drift of salaries over the study period is discernible in the plot. However, the rate of increase is smaller for females. The female starting salaries seem to be rather flat. The spread increases over time for both male and female salaries. On the plot, several males stand out as having much higher salaries than other employees hired at approximately the same time.

Does the scatterplot prove sex discrimination (that males receive higher starting salaries because they are males)? Not necessarily. Although the scatterplot clearly indicates that the males, as a group, received larger starting salaries than the females, we cannot claim that this disparity is attributable to sex discrimination. The scatterplot is consistent with discrimination, but other possible explanations cannot be ruled out; for example, the males may have had more years of education or previous experience.

Notice also that the above plot shows also the change in the gender structure over the time period. Most new clerks hired at the end of the period are females.

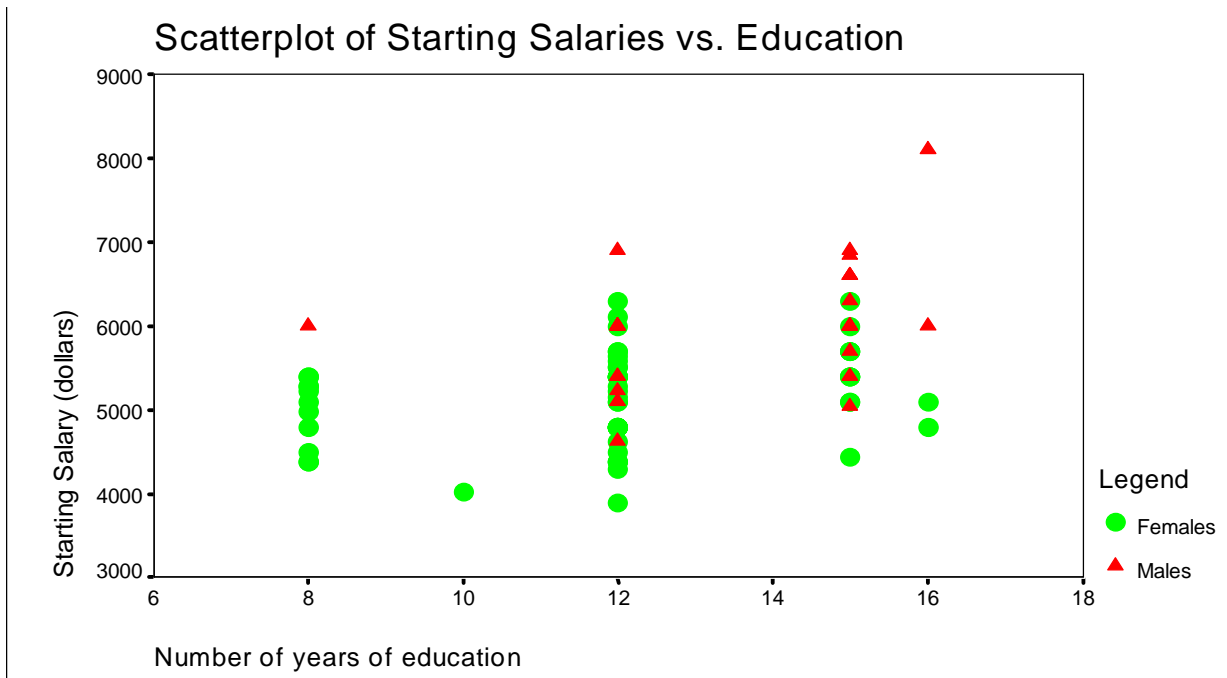
- 6.2 Did the bank discriminatorily pay higher starting salaries to men than to women with approximately the same previous experience? In order to answer the question, obtain a scatterplot of starting salaries versus the number of months of prior experience for males and females. Use different marking symbol on the plot to denote male and female subjects.

The following plot shows the scatterplot of salaries versus prior experience:



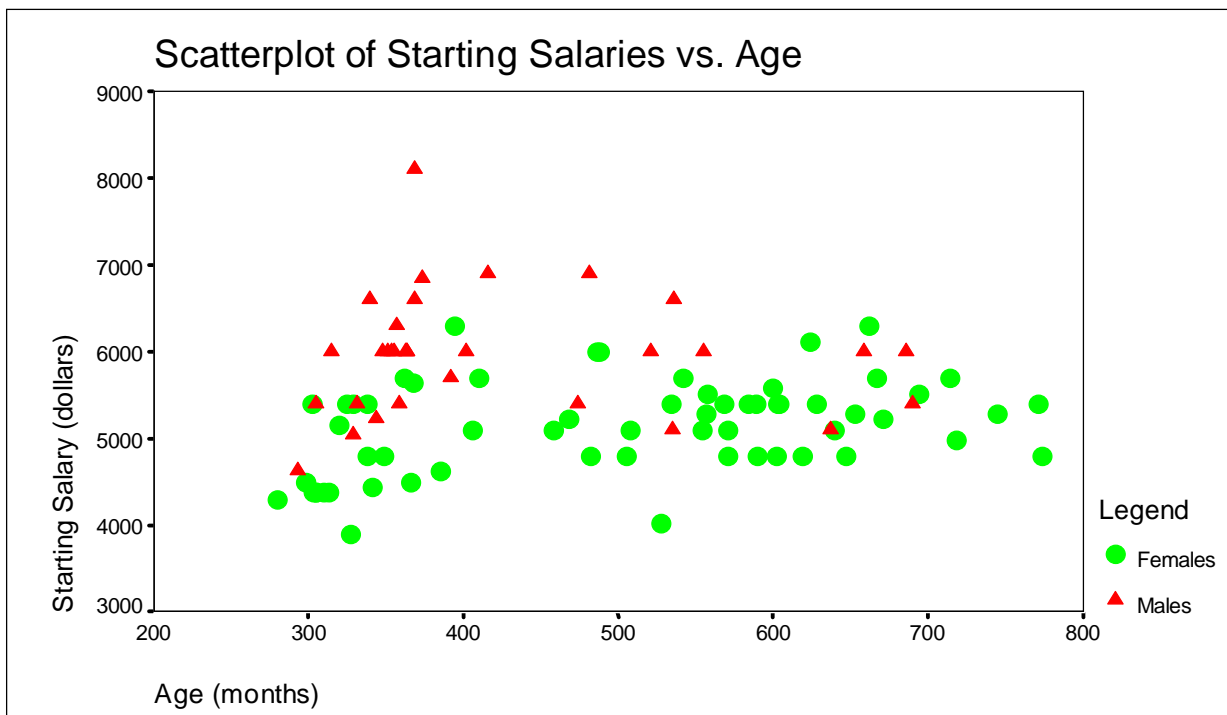
It is clear from the above plot that the males tend to receive higher salaries than females with the same number of months of prior experience. The plot also shows that male employees tend to have less previous experience than females. Since only entry-level jobs are being considered, there is an effect of diminishing returns in the relationship of experience on beginning salary. There is an evident increase of beginning salaries up to about 80 month of prior experience. But then relationship seems to level off. For an entry-level position, very large amounts of experience do not correspond to large beginning salaries.

- 6.3 Did the females tend to receive lower starting salaries than similarly educated males? In order to answer the question, obtain a scatterplot of starting salaries versus the number of years of education for males and females.



The starting salaries increase with the number of years of education. The rate of increase is faster for males.

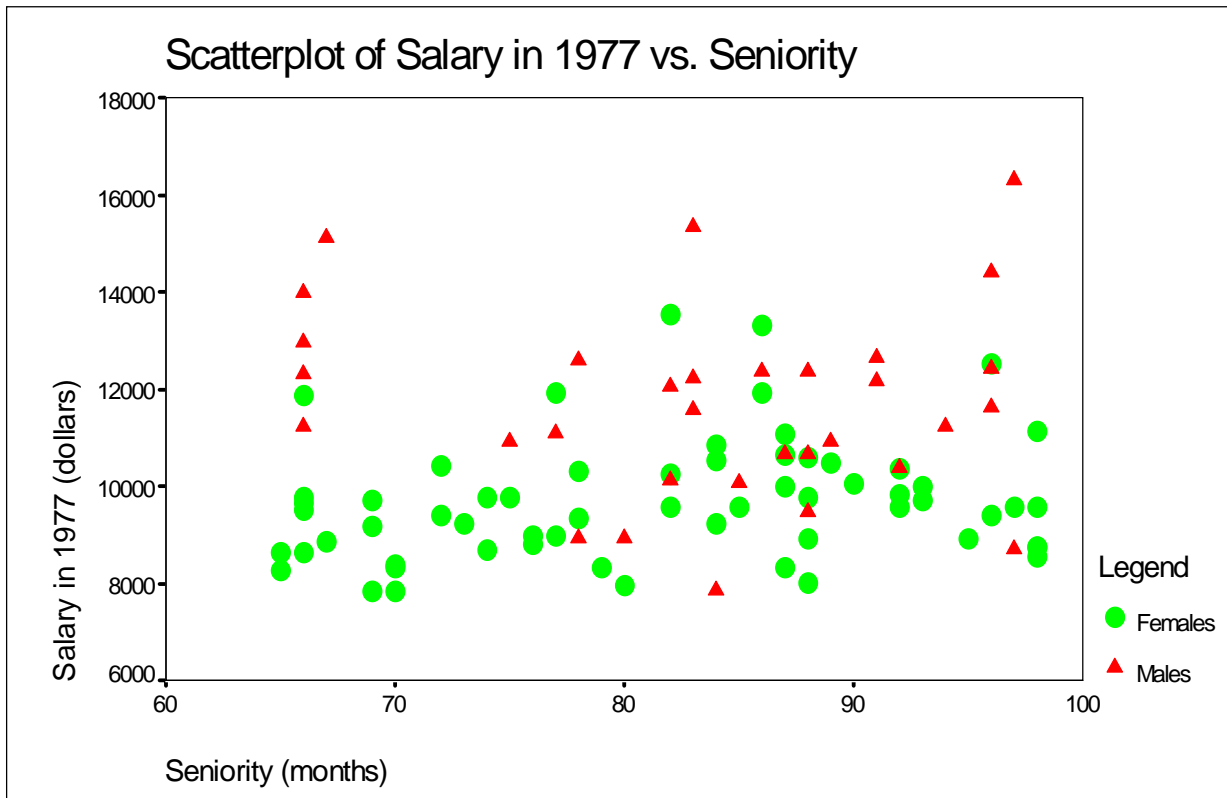
6.4 Did the older employees tend to receive lower starting salaries in our case study? Did the female employees tend to be older than the male employees? In order to answer the two questions, obtain first a scatterplot of starting salaries versus age for males and females.



As you can see the older employees tend to receive lower starting salaries. Indeed, the positions considered in the case study are entry-level clerical jobs. These positions are usually granted to young people with no or little prior job experience. Older applicants have smaller chances to get the job, and even if they do the employer very likely takes advantage of their age by offering them lower salary. Older employees are also considered to be slow learners and not that willing to take over different job

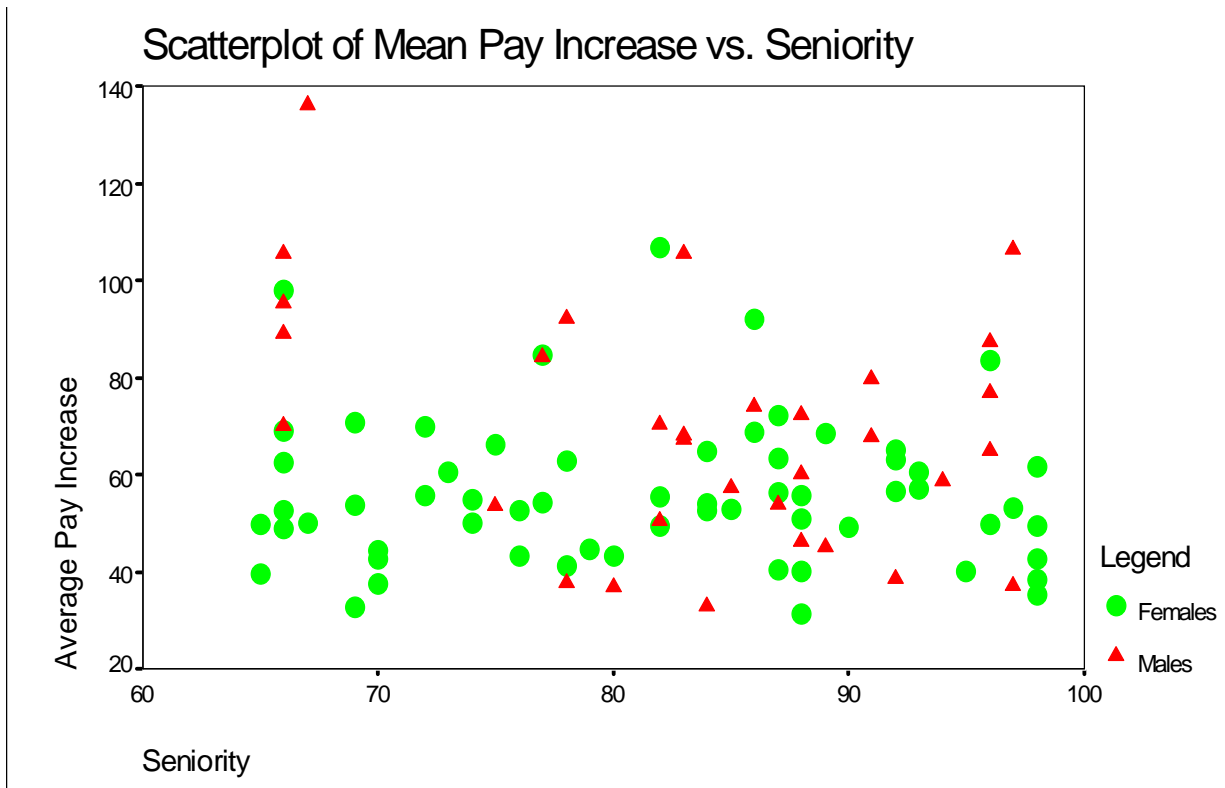
responsibilities when needed. The plot also shows that the female employees tend to be older than the male employees.

- 6.5 Did the bank pay higher salaries in 1977 to men than to women with the same seniority? Answer the question by obtaining a scatterplot of salaries in 1977 versus seniority for the males and the females on the same plot.



Based on the above scatterplot, we can say that the salaries of males in 1977 tend to be higher than the salaries of females hired at the same time. However, the observed disparity does not seem to be that large as in the case of starting salaries. Some females received significant pay increases during their employment with the bank. Comparison with the similar plot of starting salaries shows that the level of salaries in 1977 is strongly affected by the levels of starting salaries.

- 6.6 Did females tend to receive smaller pay increases than similarly experienced (in terms of seniority) males during their employment with the bank?

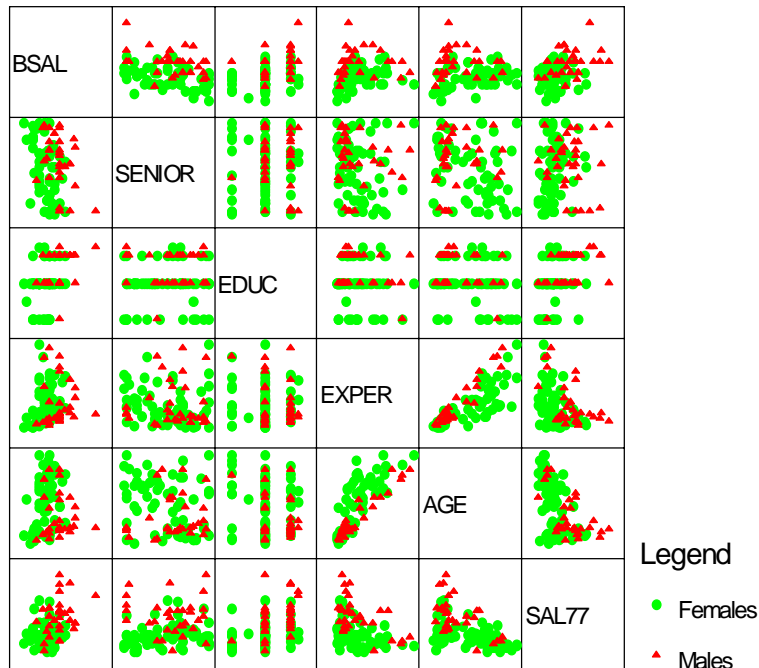


Based on the above scatterplot, we cannot conclude in general that the males tend to receive higher average pay increases compared to the females hired at the same time. This would be true for employees hired in the third year of study (seniority between 65 and 76) only. Notice that a relatively small number of males were hired at this time period. However, over the three-year period some females received much higher increases than the males. It seems that some females were underestimated at the time of hire. Notice also larger variation of pay increases for the males.

Is the conclusion consistent with that one reached in Question 4.6? We used then side-by-side boxplots to demonstrate that females tend to receive lower pay increases than males. However, the boxplots didn't enable us to compare the average pay increases between males and females hired at the same time. The males gained more, on average, in general, but nevertheless many women received much higher average pay increases than many males hired at the same time.

- 6.7 Use SPSS to create a scatterplot matrix with the following six variables: Age, EDUC, SAL77, SENIOR, BSAL, EXPER. The variable FSEX (gender) should be treated as a grouping variable.

Scatterplot Matrix for the Discrimination Problem

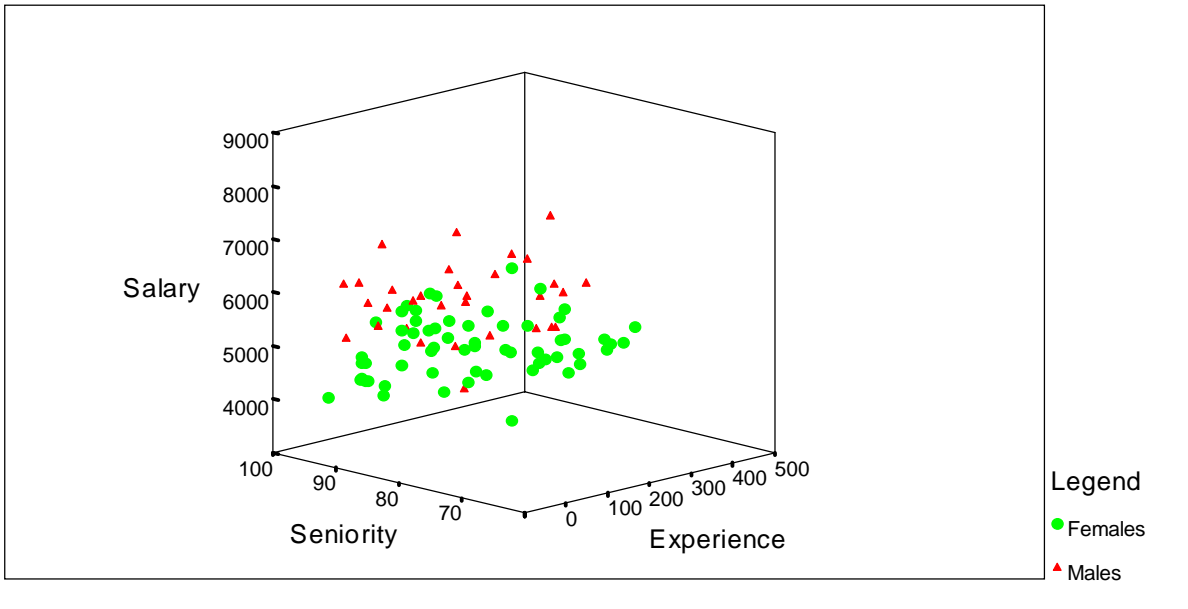


The scatterplot matrix displays scatterplots for pairs of variables in an array of rows and columns. The variable labels are given on the diagonal. For example, the bottom row shows EXPER versus each of the remaining variables in the various columns, with EXPER on the vertical axis.

- 6.8 In order to support the sex discrimination claim we need to show that similarly qualified males tended to receive higher starting salaries than females. Thus we would like to compare the salaries of males with the salaries of females with the same education, prior experience, seniority, and age. Two-dimensional scatterplots can be used to compare the starting salaries versus only one of the above variables. In order to compare the starting salaries of males and females with approximately the same characteristics for the remaining variables we need more than two dimensions in our scatterplot.

Now we will use SPSS to obtain a three-dimensional scatterplot of starting salaries versus number of years of education, prior experience, and seniority. SPSS enables you to rotate the 3-D scatterplot about one of three axes.

3-D Plot of starting salary, education, prior experience



In general, a three-dimensional plot is difficult to interpret, since what we see depends on our viewpoint. SPSS allows the plot and axes to be rotated and viewed from many different angles to look for interesting relationships. For the details, see the *Computer Instructions* module. On the page, the three-dimensional scatterplot is of somewhat limited use. As you can see in SPSS, the males tend to receive higher starting salaries than females with the same education, prior experience, and hired in approximately the same time.

We have seen above that females usually have less years of education than males. Is the extent of the disparity between males and females starting salaries justified by this factor? In other words: After accounting for the differences in education background and prior experience, did females tend to receive smaller starting salaries than males?

It is impossible to answer the question using scatterplots. We need statistical tools that make it possible to measure the effects of gender alone on starting salary. These tools are based on multiple regression and will be discussed in one of the future labs.