Analysis of Annual Salary Differences Between the Different Ranks of the Los Angeles Police

Department and the Los Angeles Fire Department

Sangjun Han, Christine Lee, Meng Lin

University of California, Los Angeles

Analysis of Annual Salary Differences Between the Different Ranks of the Los Angeles Police

Department and the Los Angeles Fire Department

Software Package

The software package used for statistical analysis is Stata. Stata was chosen because it is

a more powerful and flexible statistical package compared to SAS and SPSS.

Description of Dataset

The dataset used for statistical analysis is payroll data from the City of Los Angeles. The

dataset contains payroll information for all LA City Departments since 2011, updated on a

quarterly basis by the LA City Controller's Office (Los Angeles City Controller). The dataset

originally contained 265, 065 observations and 35 variables. We later subset the data to address

our research question.

Objective

The objective is to analyze the annual salary differences between the different ranks of

the Los Angeles Police Department and the Los Angeles Fire Department. In addition, we seek

to predict projected annual salary of each individual. The hypotheses for testing are as follows:
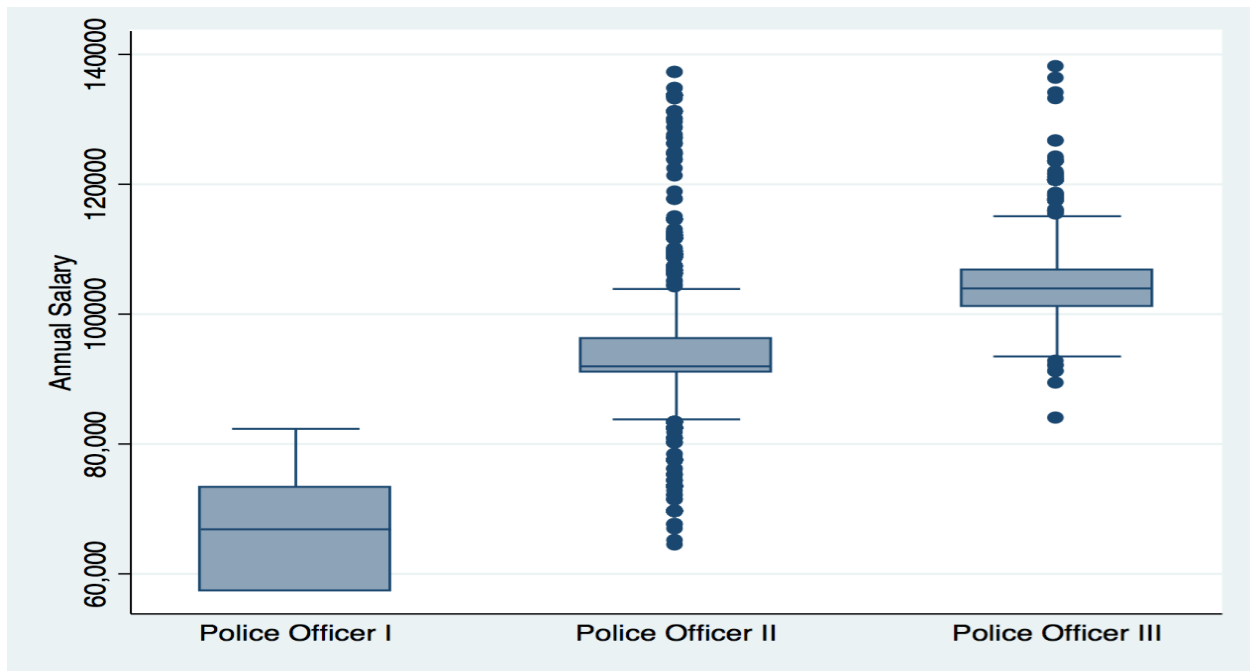
ANOVA

H_0: The mean of annual salaries amongst different types of job class titles are not significantly

different.

H_1: The mean of annual salaries amongst different types of job class titles are significantly

different.

Descriptive Statistics
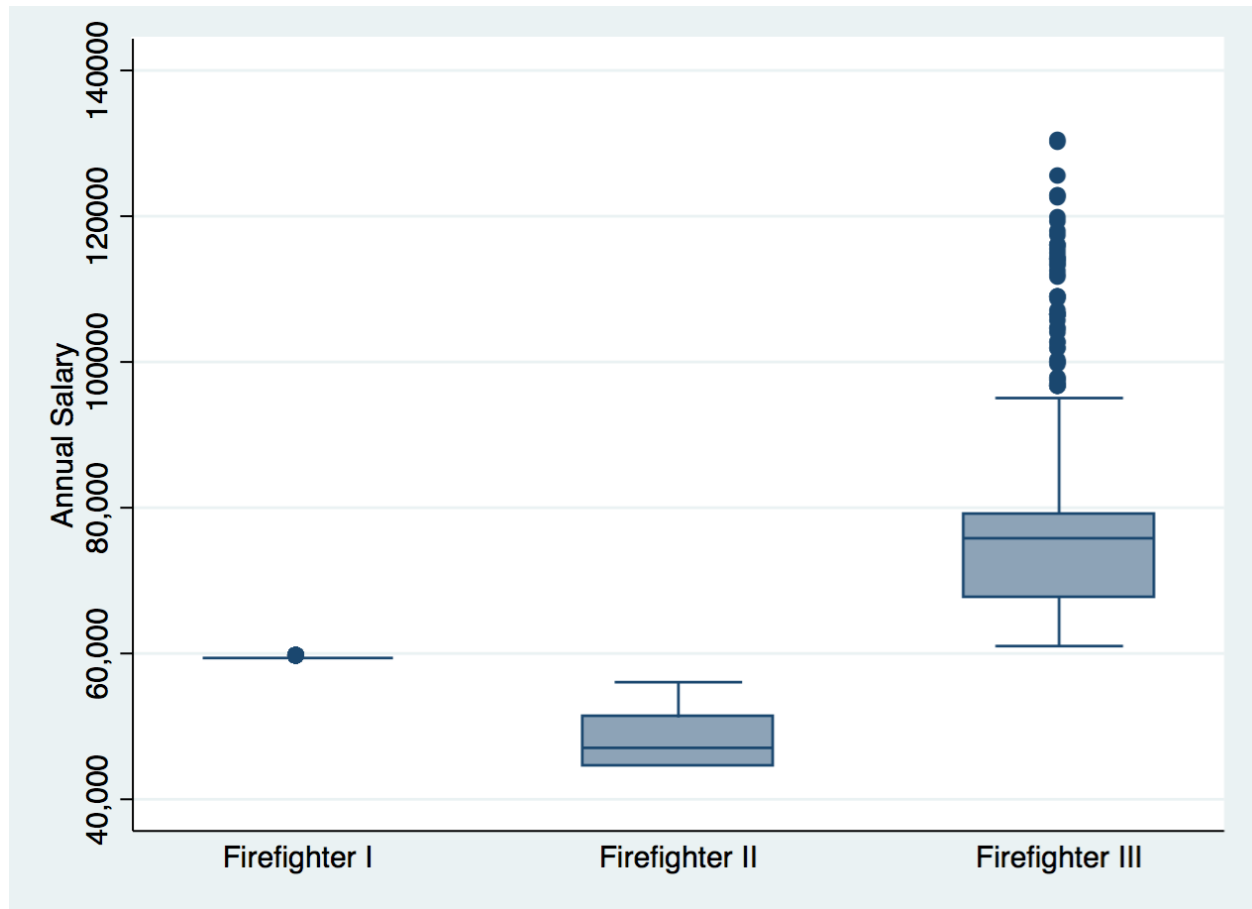
Graph 1: Box Plot for Annual Salary for LAPD

The annual salary for LAPD in different ranks is illustrated. It should be noted that rank two

officers' salaries have a very large range despite the title.

Table 1: Summary Statistics for Annual Payment for LAPD

```
. keep if departmenttitle=="Police (LAPD)"
(1952 observations deleted)

. summarize annual
```

| Variable	Obs	Mean	Std. Dev.	Min	Max
annual	6914	94380.36	12448.5	57420	138058.6

Graph 2: Box Plot for Annual Salary for LAFD

The annual salary for LAFD in different ranks is illustrated. It should be noted that rank two

firefighters' salaries are on average less than rank one firefighters.

Table 2: Summary Statistics for Annual Payment for LAFD

```
. keep if departmenttitle=="Fire (LAFD)"
(6914 observations deleted)

. summarize annual
```

Variable	Obs	Mean	Std. Dev.	Min	Max
annual	1952	73159.23	10713.64	44653.37	130155.5

Graph 3: Correlation Plot
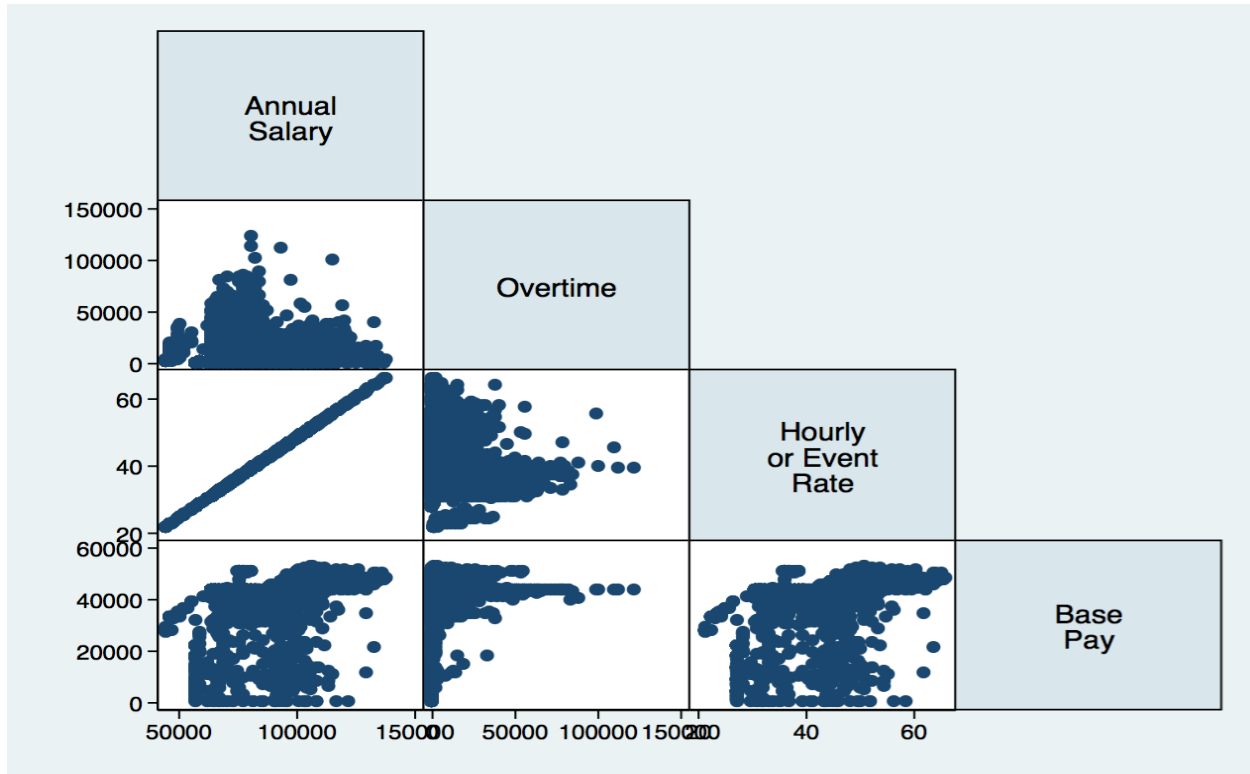
The most correlated variables are annual salary and base pay.

Table 3: Correlation Matrix

```
. correlate annual newovertime newhourlyoreventrate newbasepay
(obs=8866)

             |   annual newove~e newhou~e newbas~y
-------------+------------------------------------
      annual |   1.0000
 newovertime |  -0.3005   1.0000
 newhourlyo~e |   1.0000  -0.3005   1.0000
  newbasepay |   0.5717   0.1034   0.5717   1.0000
```

Results and Interpretation

Table 4: Regression

```
. regress annual newovertime newhourlyoreventrate newbasepay

      Source |       SS       df       MS              Number of obs =    8866
-------------+------------------------------           F(  3,  8862) =       .
       Model |  1.9807e+12      3  6.6024e+11           Prob > F      =  0.0000
    Residual |  142262.861   8862  16.0531326           R-squared     =  1.0000
-------------+------------------------------           Adj R-squared =  1.0000
       Total |  1.9807e+12   8865   223432681           Root MSE      =  4.0066
```

annual	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
newovertime	-.000016	4.02e-06	-3.99	0.000	-.0000239	-8.15e-06
newhourlyoreventrate	2088.076	.008071	2.6e+05	0.000	2088.06	2088.092
newbasepay	-4.20e-06	6.53e-06	-0.64	0.520	-.000017	8.60e-06
_cons	-2.996103	.2852859	-10.50	0.000	-3.55533	-2.436877

We are predicting annual salary from overtime salary, hourly and event rate and base pay. We did multiple linear regression and see from the table that overtime rate, hourly and event rate are significant variables since their p-value are smaller than 0.05. So our linear model looks like:

annual = -2.996 - 0.00016 overtime + 2088.076 hourly or event rate - 4.2*10^6 basepay

Table 5: ANOVA

```
. tabulate jobclasstitle, summarize(annual)
```

	Summary of Annual Salary		
Job Class Title	Mean	Std. Dev.	Freq.
Firefighter I	59382.72	0	68
Firefighter II	48242.163	3184.7159	86
Firefighter III	74872.063	9181.9772	1798
Police Officer I	65652.933	7217.6339	531
Police Officer II	93021.998	8761.01	4278
Police Officer III	104387.63	5271.4441	2105
Total	89708.166	14947.665	8866

.

:

The ANOVA table shows that the means of annual salary are significantly different among 6 different types of groups. Therefore, we reject the null, and each 6 groups are independent.

Conclusion

After statistical analysis, it can be concluded that police officers and firefighters of Los Angeles have notable differences in salary in different aspects. Police officers have a higher annual salary overall compared firefighters. LAPD has a more evenly distributed pay according to rank, whereas LAFD rank one are paid more than rank two on average. This piece of information is very interesting and could be further investigated. Just from frequency itself, it is observed that there is a higher concentration of rank 3 firefighters than any other rank, which can mean that LAFD may not really regard rank as much.

A prediction of annual salary was made based off a linear model based on overtime rate, hourly or event rate, and base pay. These variables were chosen based off of analysis of regression and correlation. From the $R_{squared} = 1$, it can be concluded that the fit of the model is fit very well.

References

Los Angeles City Controller. (2017, June 4). *Payroll*. Retrieved December 10, 2017, from

https://controllerdata.lacity.org/Payroll/Payroll/qjfm-3srk/data