Final Report

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# Introduction

The question we are examining is “how does a company’s performance impact the salary of the CEO?” We will be looking specifically at how return on equity and return on stock affect the salary of CEOs. We want to see if the positive metrics associated with increased salary have a negative impact with a decrease as well i.e. is there a linear relationship or some non-linear relationship. We would also like to see how industry plays a role in the relationship between salary and salary growth of the CEO. This is an interesting question because the CEOs primary purpose is to expand and increase profitability and stock price within a company, and it will be interesting to see if the data supports the idea that CEOs should be paid according to their performance.

# Data

For our term project, we will be using the dataset “ceosal1” found in the Wooldridge data sets which is a random sample of data reported in the May 6, 1991 issue of Businessweek. The data set includes 209 observations on 12 variables, notably CEO salary, sales, return-on-equity, return-on-stock and industry.

Here is a list of our variables and how they are measured.Our dependent variable is salary. salary is CEO’s 1990 salary measured in thousands of dollars.The rest of the variables are independent variables.Pcsalary is the change in the ceo’s salary measured in percentages. Sales is the amount of sales in 1990 for the firm measured in millions of dollars. Roe is the firm’s return on equity measured in percentage. Pcroe is the percentage change in roe and ros is the return on the firm’s stock.We also have lsalary and lsales which measure the natural log of salary and sales, respectively. Then within our independent variables, we have 4 dummy coded variables for the four firm industries. We have indus which equals 1 if it is an industrial firm, finance which equals 1 if it is a financial firm,and utility which equals 1 if it is a utilities or transport firm. Our base case is that the firm is a consumer product firm, so each of those variables is evaluated against the comparison that the firm is a a consumer product firm.

# Emperical Framework

We would use log-level based on our inputes since is .032 compared to the .14 for level-level.

We wanted to test if

We decided to keep the pcroe. It might not be independently significant but it is jointly significant with pcroe.

This model was not used!!

reg6 <- lm(lsalary~ roe + ros + I(ros^2)+ sales+ I(sales^2) + pcroe + finance + indus + utility, df)

#THE PAPER The first assumption (MLR.1) is that our model is linear in parameters. All of our regressions are linear in parameters. The second assumption (MLR.2) is that of random sampling. We can reasonably assume that our study was conducted with random sampling. The third assumption (MLR. 3) is no perfect collinearity and although we have a mild multiplicity between a few of our variables there is no perfect collinearity. The fourth assumption (MLR. 4) is zero conditional mean. This will be true for our model. The fifth assumption of homoscedasticity will hold, we tested by the BP test for reg5 (see results). The sample size should be large enough that we don’t need assumption # 6. Because all of the assumptions hold, OLS is the Best Linear Unbiased Estimator. Our regression will use OLS.

## Models 1 & 2

We know that there are many factors that effect the CEO salary, so these first two models were to be a baseline to compare against future models, we can also determine whether to use level-level or the log-level form of the models.

Model 1:

Model 2:

When we compare the two models, for model 1 was .032, while for model 2 it was .14. This proves that the log-level model is preferred because it can model the diminished returns. For future models we now know to us the log-level model.

## Model 3 & 4

In our Model 3 we added all the variables from ceosal1 to see what was significant and what wasn’t. To our surprise only one was not significant. We decided to take out pcroe, to our surprise again decreased. We did the LinearHypothesis test with “roe” and “pcroe,” and it turned out they were jointly significant. We decided to keep pcroe for future models.

Model 3:

Model 4:

## Model 5 & 6

In our Model 5 we tried to include a quadratic variable to see the effect on salary. We squared ROE but seemed to have no effect. In our Model 6 we squared sales which raised our to .296.

Model 5:

Model 6:

## Model 7

# Results

## Regression Results

Model used for predictions:

Our equation for estimation is

Our and , with 199 degrees of freedom and 209 observations.

Our base for the industry category is consumer product.

##Intepreting Regression Results ((Coefficients, R2, adjusted-R2, F and t statistics, and etc)

**Coefficients**

, which means that when return on equity increases by 1 unit the CEO’s salary is predicted to increase by . (0.008\*1000 = 8)

, which means that when return on stock increases by 1 unit the CEO’s salary is predicted to increase by . (0.002\*1000 = 2)

, which means that when increases by 1 unit the CEO’s salary is predicted to decrease by . (0.00001\*1000 = 0.01)

, which means that when sales increases by 1 unit the CEO’s salary is predicted to increase by . (0.00004\*1000 = 0.04)

, which means that when increases by 1 unit the CEO’s salary is predicted to decrease by . (0.000\*1000 = 0.00)

, which means that when pcroe increases by 1 unit the CEO’s salary is predicted to increase by . (0.0004\*1000 = 0.40)

, which means that when the company is a financial firm, the CEO’s salary is predicted to decrease by relative to a consumer product firm which is our base variable. (0.062\*1000 = 62)

$hat\beta\_8 = -0.231`$, which means that when the company is an industrial firm, the CEO’s salary is predicted to decrease by relative to a consumer product firm which is our base variable. (0.231\*1000 = 231)

, which means that when the company is a financial firm, the CEO’s salary is predicted to decrease by relative to a consumer product firm which is our base variable. (0.520\*1000 = 520)

**, Adjusted , and F-Statistics** which means that 32% of the variability within the data is explained by our regression equation, which isn’t super high. We interpret this to mean that there are other variables that reflect a large portion of the variability that we don’t have in the data.

which is lower because we have more variables and your adjusted is penalized by more variables. However the difference is very small compared to the normal

which shows the joint significance of the variables. At least one independent variable is related to Y, in our case CEO salary.

## Hypothesis Testing

Our first hypothesis is that:ROE had a higher impact than Sales.

Our p-value was 0.07058 which indicates significance at a 90% confidence level. This leads us to reject the null and conclude that ROE has a higher impact than Sales on CEO salary.

Our second hypothesis was that:Industry has a large impact on the CEO’s salary.

Our p-value was 2.641e-05 indicating significance at the 95% confidence level. This leads us to reject the null and conclude that industry does have a large impact on the CEO’s salary.

These two hypotheses help us to understand the significance of different variables relative to others.

## Confidence Intervals

Our confidence intervals at a 95% confidence level is shown in the table above for each variable. This means we can say we have 95% confidence that an observation will fall within the distribution.

## Test for Heteroskedasticity

Our p-value is above 0.05 so we can say that there is not heteroskedasticity present after performing our BP test.Heteroskedasticity is bad because it makes it more difficult to interpret the measurements that we can get from our data about significance.

# Conclusion

Through our analysis, we were able to test our theories and ideas about the relationship between a CEO’s salary and the performance of their firm. We found that there is a positive relationship between performance and CEO salary; however, there are diminishing returns to their performance.

We also found that consumer product firms will pay CEOs the highest on average holding all else constant, and then in descending order finance firms, industrial firms, and utility firms. Overall, our final equation can explain about 1/3 of the variability within the data.

Since our is lower than we would hope for that likely means that there are other variables not included in our data that can have a significant explanation for the variation in the data.