Chapter 4 Exercise 3

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Load data and view

```
load("Ch4_Exercise3_Presidents_and_Economy.RData")
pres_dta <- dta
View(pres_dta)
```

3a. Estimate model with unemployment as dependent variable and LagDemPresident as independent variable. Interpret coefficients

```
#Estimate model with unemployment as dependent variable and LagDemPresident as independent variable. Su
model1 <- lm(pres_dta$Unemployment ~ pres_dta$LagDemPresident)
summary(model1)
```

```
##
## Call:
## lm(formula = pres_dta$Unemployment ~ pres_dta$LagDemPresident)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.3806 -1.2084 -0.3806  0.7916  4.3194
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 6.2361     0.2639  23.630   <2e-16 ***
## pres_dta$LagDemPresident   -0.9555     0.3880  -2.463   0.0164 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.583 on 65 degrees of freedom
## Multiple R-squared:  0.08534,    Adjusted R-squared:  0.07127
## F-statistic: 6.065 on 1 and 65 DF,  p-value: 0.01645
```

A coefficient of -0.9555 means that a 1 unit increase in the Lag Dem President variable (with a value of 1 meaning the president in the previous year was a Democrat) is associated with a decrease in the unemployment rate of -0.9555 percentage points.

3b. Estimate model with ChangeGDPpc as depdendent variable and LagDemPres as independent variable. Interpret coefficients. Why is the sample size different from the first model?

```
#Create linear model 2, with ChangeGDPpc as depdendent variable and LagDemPres as independent variable.
model2 <- lm(pres_dta$ChangeGDPpc ~ pres_dta$LagDemPresident)
summary(model2)
```

```
##
## Call:
## lm(formula = pres_dta$ChangeGDPpc ~ pres_dta$LagDemPresident)
```

```
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2119.3  -217.0   110.3   403.1  1209.9
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  481.1      111.4   4.318 7.44e-05 ***
## pres_dta$LagDemPresident     220.0      164.0   1.341    0.186
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 589.6 on 50 degrees of freedom
##   (15 observations deleted due to missingness)
## Multiple R-squared:  0.03474,    Adjusted R-squared:  0.01543
## F-statistic: 1.799 on 1 and 50 DF,  p-value: 0.1858
```

A coefficient of 220.0 means that a 1 unit increase in the Lag Dem President variable (with a value of 1 meaning the president in the previous year was a Democrat) is associated with an increase in Y of 220% increase in GDP. The sample size is different from the first model because 15 observations were dropped due to missing values. We can do a quick check below as to which values are missing.

```
#Use is.na function and specify ChangeGDPpc column
is.na(pres_dta$ChangeGDPpc)
```

```
##  [1]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [12]  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [23] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [34] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [45] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [56] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [67] FALSE
```

3c. Choose a significance level (alpha) and alternative hypothesis, and indicate for each model above whether you accept or reject the null hypothesis.

For the 3a. model above, with a significance level of 0.05, I choose an alternative hypothesis that a 1 unit increase in the LagDemPres variable is associated with a large drop in the unemployment rate. An estimated coefficient of -0.9555 suggests that we can reject the null.

For the 3b. model above, with a significance level of 0.05, I choose an alternative hypothesis that a 1 unit increase in the LagDemPres variable is associated with a large drop in the unemployment rate. An estimated coefficient of -0.9555 suggests that we can reject the null.

3d. Explain what the p value means for the LagDemPres variable in each model

The p value is the probability of seeing a coefficient as extreme as observed if the null hypothesis were true.

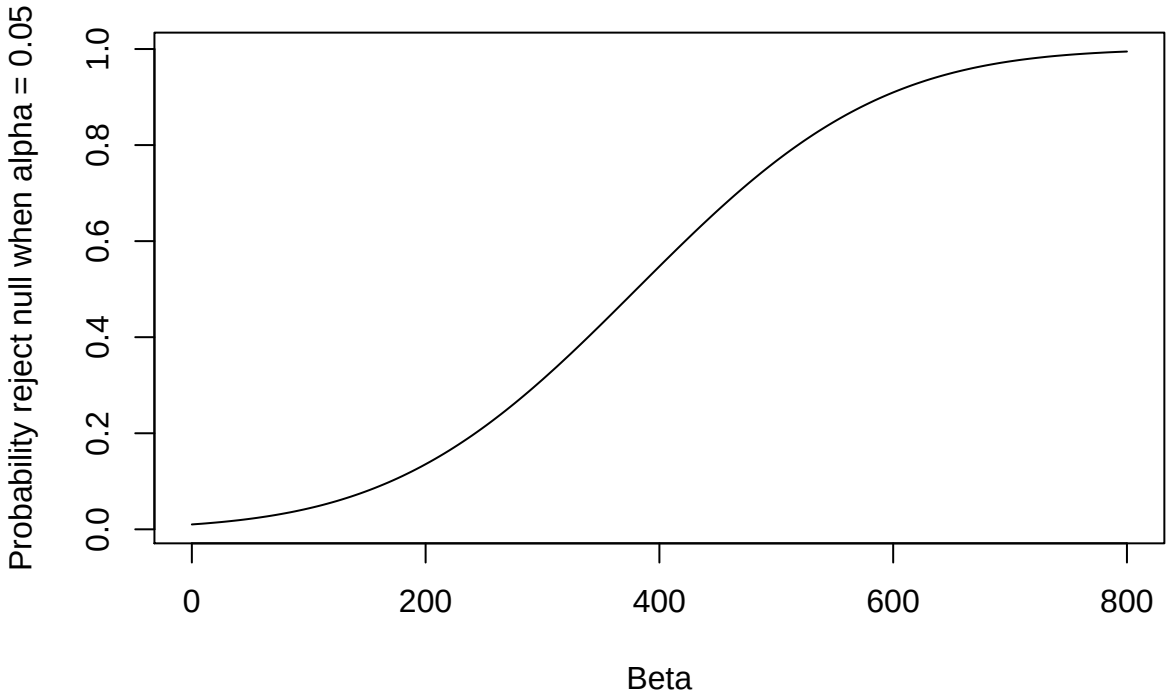
In the first model, with unemployment as the dependent variable and LagDemPresident as the independent variable, the p value is 0.01645. This value suggests a 0.01645 probability of seeing a coefficient attached to the Lag Dem President column under the null hypothesis. Since the rule of thumb is to reject the null if the p value is less than alpha (0.05), we can reject the null.

In the second model, with ChangeGDPpc as the depdendent variable and LagDemPres as the independent variable, the p value is 0.1858. This value suggests a 0.1858 probability of seeing a coefficient attached to the Lag Dem President column under the null hypothesis. Since the rule of thumb is to reject the null if the p value is less than alpha (0.05), we can not reject the null.

3e. Create power curve for model with ChangeGDPpc as dependent variable for alpha = 0.01 and a 1-sided alternative hypothesis. Explain what the power curve means by indicating what the curve means for true Beta-1 = 200, 400, and 800.

```
BetaRange <- seq(0, 800, 4)
stderrorBeta <- 164.0
PowerCurve <- pnorm(BetaRange/stderrorBeta - 2.32)

plot(BetaRange, PowerCurve, xlab="Beta", ylab = "Probability reject null when alpha = 0.05", type="l")
```



According to the power curve above, a true beta one value of 200 is associated with approximately 0.17 probability of rejecting the null. A true beta one value of 400 is associated with approximately 0.58 probability of rejecting the null. A true beta one value of 800 is associated with approximately 0.97 probability of rejecting the null.

3f. Discuss implications of the power curve for the interpretation of results for the model in which ChangeGDPpc was dependent variable (3b).

The results from the power curve above indicate that the probability of rejecting the null converge upon 1 as the true beta one value moves past 800. Conversely, the probability of rejecting the null is small as the beta one value decreases. If the standard error of Beta hat 1 were to increase, this would lower the power.