Classwork Multiple Regression Interaction

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11/11/2020

library(tidyverse)

## ── Attaching packages ──────────────────────────────────────────────────────────────────────────── tidyverse 1.3.0 ──

## ✓ ggplot2 3.3.2 ✓ purrr 0.3.4  
## ✓ tibble 3.0.3 ✓ dplyr 1.0.2  
## ✓ tidyr 1.1.2 ✓ stringr 1.4.0  
## ✓ readr 1.3.1 ✓ forcats 0.5.0

## Warning: package 'ggplot2' was built under R version 3.6.2

## Warning: package 'tibble' was built under R version 3.6.2

## Warning: package 'tidyr' was built under R version 3.6.2

## Warning: package 'purrr' was built under R version 3.6.2

## Warning: package 'dplyr' was built under R version 3.6.2

## ── Conflicts ─────────────────────────────────────────────────────────────────────────────── tidyverse\_conflicts() ──  
## x dplyr::filter() masks stats::filter()  
## x dplyr::lag() masks stats::lag()

tribble(~WorkExperience, ~LevelofEducation, ~AnnualIncomeThou,  
 21, 6, 31.7,  
 14, 3, 17.9,  
 4, 8, 22.7,  
 16, 8, 63.1,  
 12, 4, 33,  
 20, 4, 41.4,  
 25, 1, 20.7,  
 8, 3, 14.6,  
 24, 12, 97.3,  
 28, 9, 72.1,  
 4, 11, 49.1,  
 15, 4, 52  
)->X  
X

## # A tibble: 12 x 3  
## WorkExperience LevelofEducation AnnualIncomeThou  
## <dbl> <dbl> <dbl>  
## 1 21 6 31.7  
## 2 14 3 17.9  
## 3 4 8 22.7  
## 4 16 8 63.1  
## 5 12 4 33   
## 6 20 4 41.4  
## 7 25 1 20.7  
## 8 8 3 14.6  
## 9 24 12 97.3  
## 10 28 9 72.1  
## 11 4 11 49.1  
## 12 15 4 52

#1.  
lm(AnnualIncomeThou~WorkExperience + LevelofEducation, X)->XX  
summary(XX)

##   
## Call:  
## lm(formula = AnnualIncomeThou ~ WorkExperience + LevelofEducation,   
## data = X)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -18.546 -6.084 -1.116 7.969 22.030   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -15.1510 10.6501 -1.423 0.188567   
## WorkExperience 1.5232 0.4642 3.281 0.009510 \*\*   
## LevelofEducation 5.5682 1.0675 5.216 0.000552 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.3 on 9 degrees of freedom  
## Multiple R-squared: 0.8026, Adjusted R-squared: 0.7587   
## F-statistic: 18.3 on 2 and 9 DF, p-value: 0.0006747

#2.  
lm(AnnualIncomeThou~WorkExperience + LevelofEducation + WorkExperience:LevelofEducation, X)->Xi  
Xi

##   
## Call:  
## lm(formula = AnnualIncomeThou ~ WorkExperience + LevelofEducation +   
## WorkExperience:LevelofEducation, data = X)  
##   
## Coefficients:  
## (Intercept) WorkExperience   
## 3.0585 0.4723   
## LevelofEducation WorkExperience:LevelofEducation   
## 3.1654 0.1372

summary(Xi)

##   
## Call:  
## lm(formula = AnnualIncomeThou ~ WorkExperience + LevelofEducation +   
## WorkExperience:LevelofEducation, data = X)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -17.553 -7.081 1.268 5.299 20.965   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 3.0585 20.7446 0.147 0.886  
## WorkExperience 0.4723 1.1278 0.419 0.686  
## LevelofEducation 3.1654 2.5811 1.226 0.255  
## WorkExperience:LevelofEducation 0.1372 0.1342 1.022 0.337  
##   
## Residual standard error: 12.27 on 8 degrees of freedom  
## Multiple R-squared: 0.8254, Adjusted R-squared: 0.7599   
## F-statistic: 12.61 on 3 and 8 DF, p-value: 0.002121

#3.  
#For the original model, the R-squared value is 0.8026, Adjusted R-squared is 0.7587, and the overall p-value is 0.0006747  
#In the interaction model, R-squared is 0.8254, Adjusted R-squared is 0.7599, and overall p-valueis 0.002121.   
#These results are pretty similar.   
#However, when looking at the individual p-values for the explantory variables, in the original model, both explanatory variables are significant,   
#while in the interaction model the p values are not significant, at 0.255 and 0.686.   
#Notabley, the interaction p-value is 0.337, which is also not significant.  
#Finally, the standard error in the original model is 10.6501 while the interaction model it is 20.7446.  
#So from this analysis, the original model would be the better model to use.